This book is with
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Binding

TEXT CUT BOOK

GRAPHIC GRAFLEX PHOTOGRAPHY

The Master Book for the Larger Camera

WILLARD D. MORGAN
HENRY M. LESTER
...and thirty contributors

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GRAPHIC GRAFLEX PHOTOGRAPHY

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KEARNY

PHOTOGRAPHY IN AMERICA TODAY

The views and opinions of Roy E. Stryker and Edwin Locke, expressed in the course of many chats they have had during the preparation of this volume with its editors and contributors, are reflected in the early paragraphs of this introduction. Both have been very active in bringing about a better photographic interpretation of contemporary American life.

The camera and its product—the picture—have assumed great importance to our society. We have all learned to respect sufficiently the scientific methods to demand, somewhat naively perhaps, tangible proofs of what we accept as truth. More and more do we look to the camera, with its hard, clear and penetrating eye, and its foursquare honest look, as the instrument capable of producing evidence acceptable in a court of law, or masterpieces eagerly sought by museums.

But what of the photographer? How important is the man who manipulates the camera controls, who is responsible for the intermediate photographic processes? The man who establishes the viewpoint of the camera? One viewpoint out of many possible? He is the man who has to make this decision. And many other decisions. And by those decisions we judge him.

He makes his decisions according to what he knows. And in judging his decision we are judging his whole experience, not so much with the camera as with life itself. He may be a rank beginner with the camera, yet if he succeeds in conveying to us a fresh look at the world around us—he has done an important thing.

After all, what is a photographer? Someone who makes photographs not with a retoucher's brush and knife, but with a camera. Why does he make photographs? Because he wants to show us something we cannot get around to seeing for ourselves. And because he wants to show it to us *the way he saw it*. We call a photographer good, when he shows us something that interests us or attracts our attention. That may be a locomotive, if we are railroad hobbyists, or races, if we are fond of the track, or chorus girls, new roads, steam shovels, sewage disposal plants, billboards, sharecroppers or soldiers in action. Interests of the human being are great and varied, and the variety of these interests is what gives photography its significance.

Photography, considered as a means to record a mere likeness, is not very difficult. But photography as a new method in the age-old struggle of the human being to communicate with his fellow-beings, to make them aware of what *he* sees in the world around him, can be as exacting and rich as any of the arts. Nothing is of greater interest to us than the observations of another human being, provided they are fresh and at first hand. Yet the making of fresh observations based on a wide and lively curiosity, in the complex and largely second-hand life of today, is a great and difficult endeavor. To stand apart from the general confusion and to see sharply, takes more than ordinary understanding, whether the subject is a single person or a large group, a city block or a whole region of the country. It is necessary to understand people, how and where they live, what they do at work or at their leisure, what they have done to their environment, and what that environment has done to them.

If the subject is small in scale, understanding may be derived at first hand, from direct observation. If large, observations of others, the economic geographer, the historian, the sociologist—must be called upon. The photographer should allow no limitations to restrict his research, except that of time. In no other way will his work stand out under a test of time. Mere technical excellence can be equalled and surpassed by others almost overnight, but work based upon knowledge and understanding of the subject and of the world surrounding it will always have an honored place, not only in photographic exhibition, but whenever things of interest to people are sought. The photographer speaks through his camera, and the importance of what he has to say is limited only by his ability to express himself in terms of the language of photography and his own knowledge of the world. His task, difficult but rewarding, is to live up to the full possibilities of his medium.

However, only those who master the mechanics of photography can afford to "forget it." Mastery of the mechanics of photography is, at best, only a means to an end. Idolatry of photographic technique has never produced its masterpieces. Neither has the ability to draw

←**AMERICA'S PERPETUAL MOTION:** Rolling . . . rolling . . . rolling . . . All day long . . . All night . . . Always. Photographer Charles Phelps Cushing, went out in search of traffic congestion photographs. He found a suitable location on a bridge overlooking the traffic stream coming off the Pulaski Highway and heading for the mouth of the Holland Tunnel. Just before sunset, the top picture was snapped on Fast Pan roll film in his 4 x 5 Speed Graphic. After dark when the street lights were turned on, he made a night exposure on Fast Pan film using sheet film holders. Top picture made at 1/25 second f/11. Night photo made on cut film at ½ second f/5.6.

curved or straight lines produced masterpieces of architecture or engineering. Mechanical competence is an important prerequisite—but not an achievement.

Books on photography too are only means to an end. They aim to acquaint the photographer with the experiences and observations of others. Good photographic books are an important source of knowledge. They will enrich the photographer's background and his fund of knowledge. But they do not, and cannot, take place of his competence in the field. They are the source of second-hand knowledge easily acquired in the comfort of home. But knowledge of all the books in the world will not bring a photographer to poke a camera in the face of a hungry or wounded man. Nor help him to decide when to accept or to reject an opportunity for a photograph, so brief and so flighty that there is just time enough to "pull a slide and cock a shutter." This is where the difference will become apparent between first-hand knowledge acquired through actual experience and that knowledge which is based on hearsay only.

Photography in our time is a mass profession. And each individual equipped with his camera must learn to rub shoulders with many others similarly equipped. The resourcefulness, background, ingenuity and competence of each individual are stacked up against those of many others. And this is where opportunities arise for the display of all the knowledge acquired in the field as well as that gathered from books.

The editors of this volume, active photographers themselves, have for years been in the field. They have rubbed shoulders with other photographers. They have covered in their other publications many aspects of photography with the miniature camera, in the rise of which they have actively participated. The larger cameras have never yielded an inch of ground to their smaller and younger brothers. On the contrary, they grew too in significance and performance; their achievements in the last few years have reached spectacular levels, indeed. It was the constant growth of the field of photography itself, the constant influx of new, fresh blood into the profession which gave it the vitality it now possesses. The cameras producing negatives of larger sizes have vast possibilities, some of them not as yet exploited even by men and women who have owned and used them for years. This volume is dedicated to the user of the larger cameras who has always wished for a complete story about them.

Home Study Text

GRAPHIC GRAFLEX PHOTOGRAPHY is not a book which can be absorbed in a single gulp. It is not intended to be read overnight. Reading it will be most fruitful if it will be paralleled by actual photographic work. Each chapter of it could be extended to a volume, but even that would not accomplish any tangible improvement in the photographer's technique unless the simple information is applied practically in his own work. Considered in this light, GRAPHIC GRAFLEX PHOTOGRAPHY is a complete and thorough home-study course, which, when absorbed in connection with practical applications, will bear fruit in the form of greatly superior results.

In fact the entire book has been designed to fulfill a very immediate demand for modernized photographic information together with new material which has been created during the last two or three years. This book does not go into complicated procedures. On the contrary, the whole purpose of GRAPHIC GRAFLEX PHOTOGRAPHY is to be a practical working handbook for all photographers. The answers to a thousand and one photographic problems will be found in this volume. The elaborate index affords quick reference to all sections.

The editors and publishers urge every reader of this book to devote short periods of study along with the practical application of the camera. In this way the descriptive material found in GRAPHIC GRAFLEX PHOTOGRAPHY will become meaningful when the actual photographs are being made. For example, the chapter on Exposure could fill several weeks of intensive study and photographing. Photographic examples should be made to illustrate the various points brought out in this chapter. Experiments with different times of development and various printing papers will be a valuable short course in photography itself. From this point new ventures and explorations can be made into the use of filters and the best printing methods. In fact, any chapter can be taken as an assignment. Read the chapter thoroughly and then carry out your own photographic experiments by producing actual results. Reread the chapter a number of times during the actual photographic period. In this way the information will quickly become part of your own working procedure.

At the start, one may say that he is not interested in news photography or aerial photography. If this is the case, just read the chapters which apply to your immediate interests. Learn thoroughly the procedures presented in these chapters. As this information becomes assimilated, there will be associations which will lead into other fields. For example, one may be interested in the photography of children. This interest will undoubtedly extend into a careful reading of the chapter on Synchroflash Photography, Exposure, Color Photography, the Equipment Chapter, Illumination, the Printing Chapter and possibly the View Camera Chapter. Similar associations will come with almost any other chapter in this book. Each chapter has been so carefully written and edited that its material adds to the whole product which is a complete working program on modern photography with Graflex, Speed Graphic, and other larger cameras.

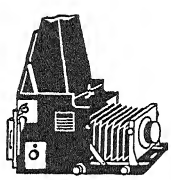
ELEMENTARY GRAFLEX AND SPEED GRAPHIC PHOTOGRAPHY

KONRAD CRAMER

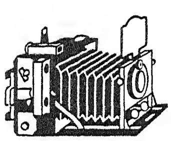
PART I:

Let's begin at the beginning! Your brand new camera rests in front of you on the table—splendid in its unmarred newness, and fragrant with mysterious odors of lacquers and varnishes. With the manufacturer's instruction book in your hand, you begin to familiarize yourself with your new treasure. You press buttons, open flaps, turn knobs, and peer at scales and numbers!

All this may be quite bewildering at the start. The manufacturer's instruction book does take care of the fundamental mechanics as related to the camera, but the novice is still in the dark regarding the relation of camera manipulation to photography; that is, THE MAKING OF PICTURES BY THE PHOTOGRAPHIC PROCESS.



GRAFLEX

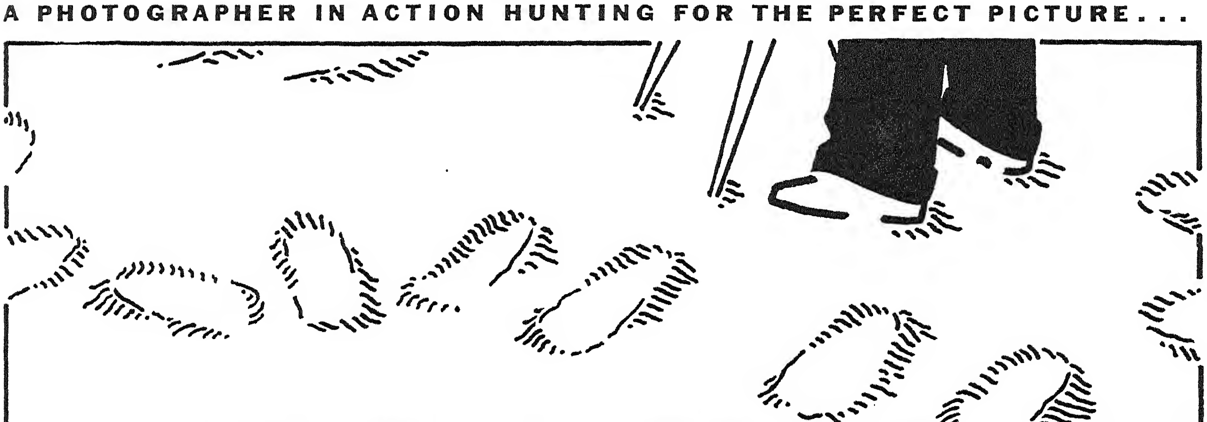


SPEED GRAPHIC

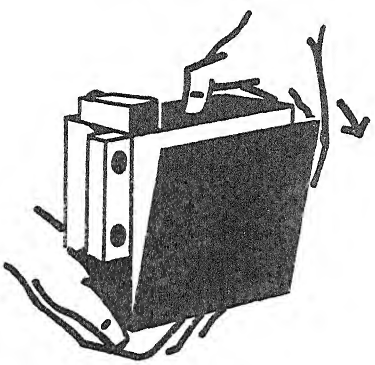
To lead the beginner to a clear understanding of this process is the purpose of this chapter. The various steps of photography are presented in the style of the "Picture Diagram" accompanied by a minimum of text. The rest of the page carries a more detailed explanation of these steps. The information contained in the narrow margin is the minimum of photographic knowledge necessary to make a correct photograph. It is sufficient for the person that has neither the time nor the inclination to go very deeply into the art.

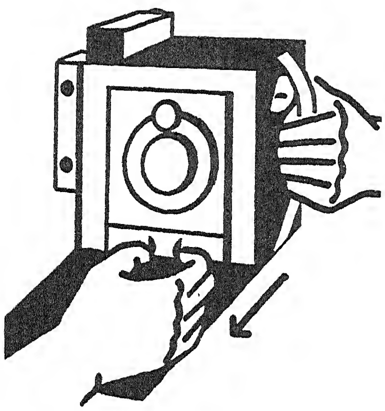
This fundamental information is amplified in the wide margin of the page. Where the operating instructions differ for GRAFLEX and GRAPHIC, the instructions are preceded by a small picture of the instrument as shown at the left of this page.

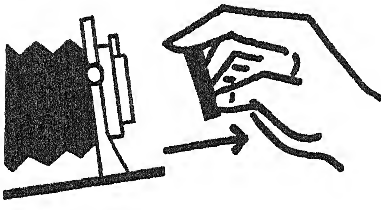
A PHOTOGRAPHER IN ACTION HUNTING FOR THE PERFECT PICTURE . . .

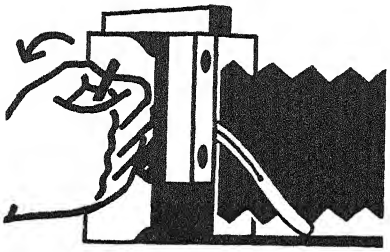


OPEN AND SET THE GRAPHIC CAMERA









Step I — So Let's Begin

The Speed Graphic is *opened by pressing* the concealed *spring* button on top of the camera (near the telescope view finder).

Swing the front down and as the spring-actuated side arms lock, the camera bed is in its extended position.

Pull out lens standard (by grasping clamp at base) *to the "infinity stop"* fastened on the bed track.

Insert "cable release" in threaded socket on the rim of the front shutter.

Remove lens cap and attach lens shade (if you have one) to lens rim. (The faithful use of a good lens shade will produce the best and most brilliant negatives.)

Before you use the camera see that the surface of the lens is clean and free from dust and dirt! (A fast lens loses speed if the light has to penetrate a layer of dust and dirt!)

To clean the lens! Be a crank about that part of photography! Use *only* the best lens tissue, and don't scrub your lens every day like a good hausfrau! A well-protected lens and camera should remain clean for a long time. The best way to remove loose dirt and lint is by blowing them off with a rubber ear syringe (not too small) which should always be carried in the camera case. This syringe can also be used to clean out the interior of the camera! Never blow on the lens with your mouth. One usually showers it with saliva which is all right if you are after a soft focus effect!

Step II — Exposure

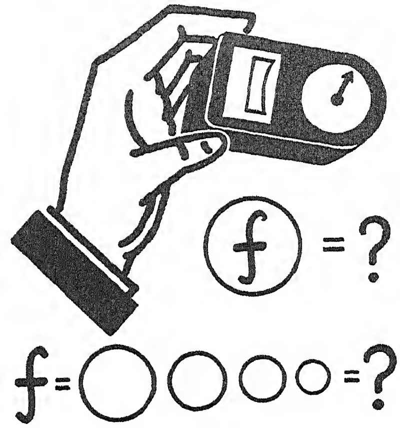
A.) To obtain a correctly exposed film it is necessary to measure the strength of the light as it is reflected by the subject to be photographed. A good electric exposure meter will accomplish this most accurately. The following facts must be considered to obtain a correct reading from your meter.

a. Outdoors—don't point meter too much towards light of sky. Obtain average between the brightest and darkest part of your scene! Read the instructions furnished by the manufacturer!

b. DON'T STAND BETWEEN THE LIGHT AND THE SUBJECT WHILE MEASURING THE AMOUNT OF LIGHT REFLECTED BY IT.

c. WHEN MEASURING THE LIGHT AS REFLECTED BY VERY SMALL OBJECTS (such as flowers against a dark or light background) TAKE CARE THAT YOU DON'T MEASURE THE BACKGROUND INSTEAD OF THE SMALL OBJECTS. TO GET A MORE ACCURATE READING TAKE A READING FROM A PIECE OF CARDBOARD THAT HAS THE SAME DEGREE OF LIGHTNESS AS THE SUBJECT.

TAKE EXPOSURE READING



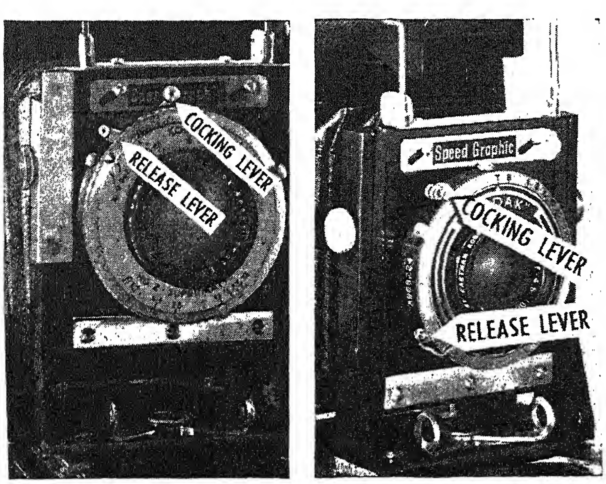
B.) *Determine film speed!* Manufacturers do not actually give a speed rating to their films because film speed is relative to development methods. Makers of light meters publish current lists of film speed ratings according to the rating system used. There is no standard of rating in the industry as yet. At present the Weston Ratings are most commonly used. Unfortunately, these various systems (Scheiner-Din H&D) can *not* be correctly converted from one system to another.

C.) Choose lens opening. Between the front and rear element of your lens you will find the "IRIS DIAPHRAGM." This is a device to control the amount of light admitted to the film. The smaller (f/32) the opening in the Iris Diaphragm, the less light is admitted to the film. The larger (f/4.5 in case of a f/4.5 lens) the opening the more light will be admitted. Therefore: A SMALL aperture (f/32) requires a LONG EXPOSURE. A LARGE aperture (f/4.5) requires a SHORT EXPOSURE.

D.) *Long* and *Short* exposures are controlled by the shutter mechanism. The Speed Graphic is usually equipped with two types of shutters, a *between-the-lens shutter* (frequently called the "front shutter") and a *focal plane* shutter at the back of the camera directly in front of the film. The front shutter furnishes speeds from 1 full second upward to 1/200, 1/250 or 1/400 depending on size and type of shutter. They also have Bulb and Time, (B) and (T) as shown on the speed setting dial illustrated below. The focal plane shutter provides speeds from 1/10 to 1/1000 second. Varying size slits in a black curtain and six different spring tensions provide a great variety of shutter speeds.

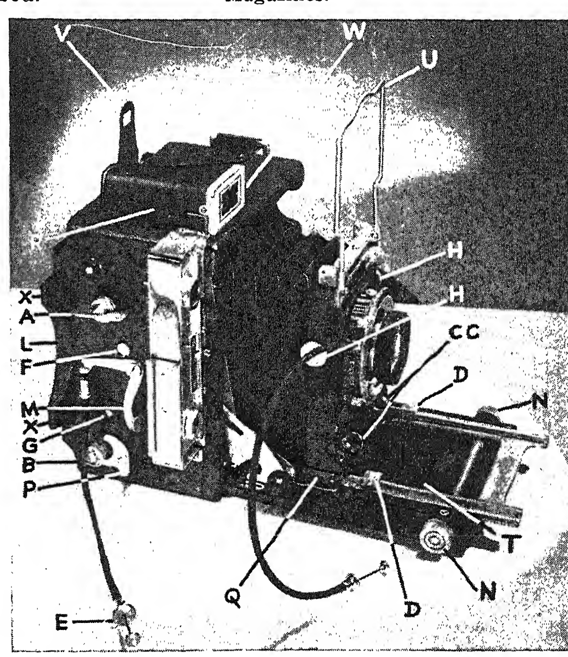
In the Graflex cameras only the focal plane shutter is used.

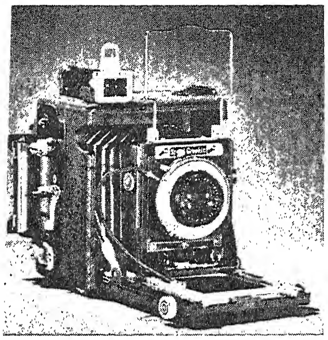
1. FRONT VIEW OF SPEED GRAPHIC, showing location of "Cocking" and "Release" Levers in two modern types of "between-the-lens" front shutters: the Supermatic (*left*) and the Rim-set Compur shutter with self-timing device (*right*). Both views also show the front standard clamp, which holds the lens standard firmly in place against the sliding track.



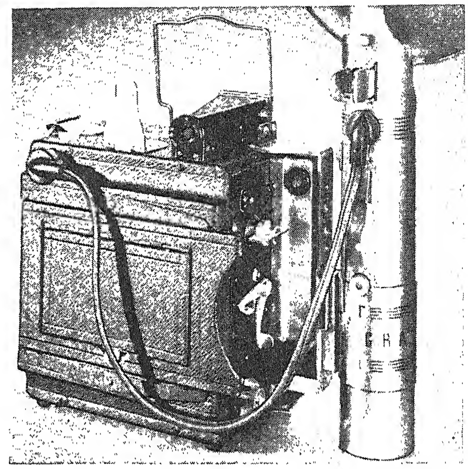
2. THE SPEED GRAPHIC CAMERA

A. Shutter Winding Key.
B. Tension Setting Knob.
C. Front Track Clamp.
D. Infinity Stop on Track.
E. Wire Cable Release.
F. Focal Plane Shutter Speeds.
G. Tension Setting Numbers.
H. Rising Front Lock.
L. Rear Focusing Glass.
M. Focal Plane Release.
N. Focusing Knob.
P. Tension Release Catch.
Q. Range Finder Slide Stop.
R. Parallax View Finder.
T. Shutter Speed Table.
U. Wire Frame Finder.
V. Rear Peep Sight.
W. Front View Finder.
X. Rear Clamp for Holding Film Magazines.

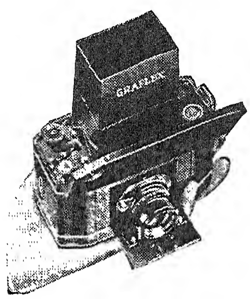




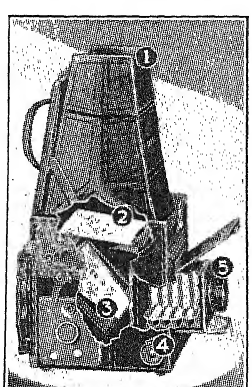
THE STANDARD SPEED RAPHIC CAMERA. Available ı 2¼ x 3¼, 3¼ x 4¼, 4 x 5, .d 5 x 7 inch sizes.



4. REAR VIEW OF THE 2¼ x 3¼ SPEED GRAPHIC CAMERA.
Note connecting cord to focal plane synchronizing unit. Flash battery case attached to encircling bracket over Kalart Lens-Coupled Range Finder.



5. NATIONAL GRAFLEX SERIES 2. 2¼ x 2½ inch picture size using No. 120 film.



6. WORKING PARTS OF THE GRAFLEX CAMERA.

1. Focusing hood.
2. Image on ground glass.
3. Reflecting Mirror.
4. Convenient focusing knob.
5. Camera lens.

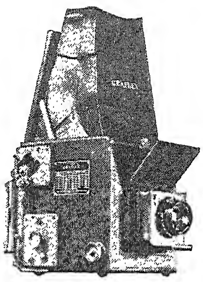
GRAFLEX CAMERAS

The Graflex cameras are equipped with focal plane shutters of exceptionally rugged construction. The various exposure speeds are obtained by varying the spring tension and by selecting the various size apertures in the shutter curtain. A wide aperture together with a weak spring tension results in a *long* exposure, while a narrow aperture and a strong spring tension provide the maximum in *short* exposures. This relation of size of opening and speed of curtain makes possible a large number of exposures.

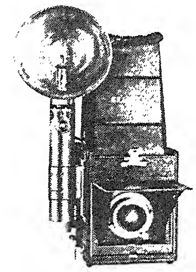
At speeds slower than 1/25 second, the Graflex should be immovably held by a *firm* tripod—and the tripping of the shutter release lever should be done with great care so as not to impart any movement or vibration to the camera! Before actually making any exposures with the Graflex, it is good practice to thoroughly familiarize yourself with the few manual operations necessary to operate this shutter and mirror combination.

When using the focal plane shutter of the Speed Graphic, be sure that the between-the-lens shutter is set on "TIME" (T) and open! Conversely, set focal plane shutter at (O) full open when using the front shutter.

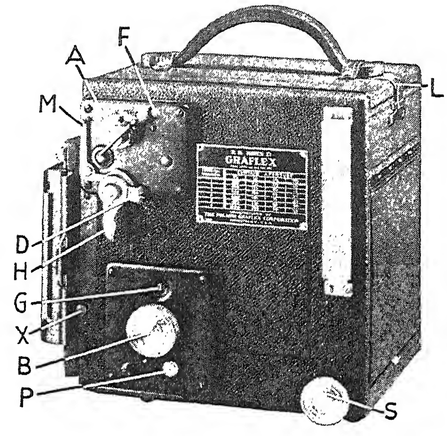
To avoid errors in operating the Front Shutter remember the following: (T) stands for time. When you press the Wire Cable release, the shutter opens and stays open until you press the release again. Set Dial to B and you have Bulb exposure. That is, the shutter remains open as long as pressure is maintained on the release! (Good for exposures of 1, 2, 3, 4 seconds). To obtain automatically timed instantaneous exposures (snapshots) set Dial at I, or Instantaneous. Set speed Dial to the required speed and cock the shutter ready for making the exposure. See Figure 1 for rim-set shutter markings.



7. SERIES B GRAFLEX. Available in 2¼ x 3¼, 3¼ x 4¼, and 4 x 5 with the revolving back . . . or 3¼ x 4¼, 4 x 5, and 5 x 7 without revolving back.



8. SERIES D GRAFLEX. Available in 3¼ x 4¼ and 4 x 5 with the revolving back feature.
The Graflex Flash Synchronizer and the Graflex Automatic Diaphragm Control Lens Mount are available with the new Super D Graflex Camera.



9. OUTSIDE WORKING PARTS OF THE GRAFLEX.

A. Shutter winding key.
B. Shutter tension setting knob.
D. Press down lever H and slide the bar D to the right, exposing T indicating Time exposures.
F. Aperture numbers for setting shutter
G. Shutter tension numbers.
H. Mirror setting lever.
L. Front clip to hold collapsible focusing hood shut.
M. Lever for releasing shutter.
S. Focusing knob.
X. When this catch is pressed in, the rear revolving back can be turned to the vertical or horizontal position as required.

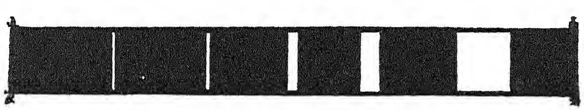
To Operate Focal Plane Shutter on the Speed Graphic and Graflex Cameras

The shutter is set by turning Key (A) to left, until the curtain aperture (width of opening in curtain) as indicated on "Speed Plate" (T) for a certain exposure is registered at circular window (F). If the curtain is already set at a smaller opening (1/8 or D on some models when a 3/4 or C on some models is wanted, for instance) release the curtain by pressing the shutter release (M) until proper aperture is in position. In the above case you have to press twice to reach 3/4 or C.

!CAUTION!
!DANGER!

For Speed Graphic users only.

The dark slide of Plate or Film Holder (Septum) (Film Pack) MUST BE IN POSITION WHEN THE SHUTTER IS SET.



10. The Graflex and Speed Graphic focal plane shutter showing the five opening widths which determine shutter speeds when the proper camera settings have been made.

Tension on the curtain is regulated by turning milled head (B) to the right until the tension number indicated on the Shutter Speed Plate for a certain exposure appears at (G). If the tension is already set for a high number, push escapement (P) back and forth until the required low-tension number is registered at (G).

Aside from these purely mechanical problems of camera manipulation the choice of the size of diaphragm opening also presents an aesthetic problem. (See chapter on Lenses)

To put things simply: When you open the diaphragm all the way (f/4.5) the sharpness in your picture will extend only over a very short distance.

R.B.GRAFLEX-SERIES D
CURTAIN APERTURE

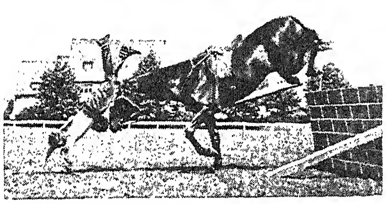
TENSION NUMBER	1/8	3/8	3/4	1½
1	350	110	40	10
2	440	135	50	15
3	550	160	65	20
4	680	195	75	25
5	825	235	80	30
6	1000	295	90	35

THE FOLMER GRAFLEX CORPORATION
15899 ROCHESTER, N.Y., U.S.A.

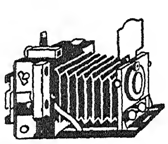
11. The shutter speed table which is attached to the Graflex or Speed Graphic cameras. The new Speed Graphic cameras have a slightly different speed table from the one shown above. The new cameras have the letters A, B, C, and D in place of the tension numbers shown above. Also the speeds are a little different; however, both tables give all the various speed ratings for the specific cameras they are used with.

BACKGROUNDS AND ACTION

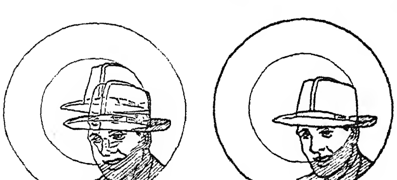
12. HARVEST TIME. Photo by Harry A. Scheer of *Providence Journal,* R. I. This picture is improved by allowing the background to fall out of focus. Note the clarity of detail throughout the entire foreground.



13. FREEZING THE ACTION at 1/1000 second with a 4 x 5 Speed Graphic camera. Photo by Carl Klein. The Graflex and Graphic focal plane shutters permit a wide selection of shutter speeds for partially or totally stopping action.



LENS COUPLED RANGE FINDER FOCUSING →



Out of Focus

In Focus

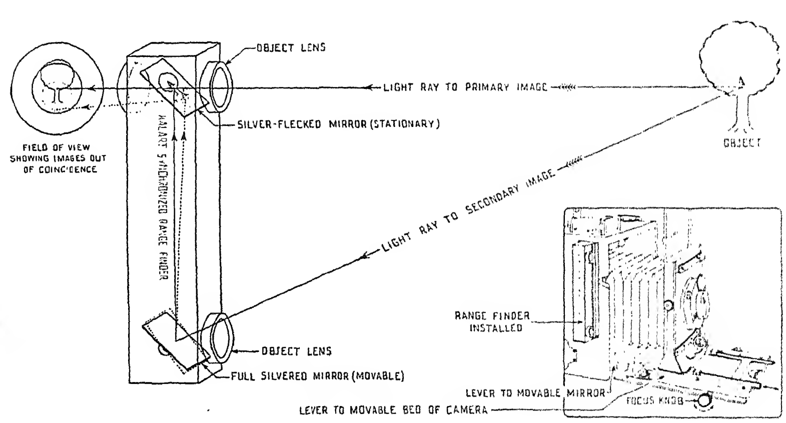
This limited field of sharpness may at times be very desirable to put emphasis on the main subject and hide disturbing details. Example: When a relative asks you to take his picture in the backyard the resulting picture will look much better if you can somewhat hide the neighbor's washline by opening your lens all the way, focusing sharp on the person in front of you. You will find that all the items in the background will be pleasurably hidden in a general blur. Just how far this field of sharpness extends depends on several factors and should be carefully studied.

E.) One of the factors determining a specific shutter speed is MOTION in the subject matter you intend to photograph. In the equipment chapter you will find a table of speeds of motion and the shutter speeds necessary to stop them. Most speeds are given for a movement at right angles to the camera . . . objects moving towards the camera require less speed. The sharper the angle of approach the less speed is necessary (1/3 less at 45°). Also remember: The closer your camera is to the moving object, the faster the shutter speed must be employed.

Sometimes it may be desirable in the interest of a more "alive" picture to not entirely stop all motion—running water, brooks, waves. When photographed with a sufficiently fast shutter speed, to stop all motion, it will result in a bit of "Frozen Nature." A little slower speed that produces just a slight "blur or drag" results in a picture that conveys the idea of flowing water much better.

Just as a racing motor car when photographed with the "correct" speed looks standing still and in no way conveys any sensation of speed!

F.) At certain times the photographer wants to change things around a bit in nature, in the hope of esthetically improving the final picture! The painter, for instance, has almost unlimited means to



14. This drawing shows the working principle of the Kalart Lens-Coupled Range Finder. The small drawing at the lower right shows the Range Finder in position on a Speed Graphic camera. Note how the bottom Range Finder mirror is adjusted. The small drawing at the left gives a very good idea about the double image and the single image showing the out-of-focus and in-focus positions of the Lens-Coupled Range Finder.

effect such changes. The poor photographer has only a few means whereby he can effect any changes in the subject matter before him.

Colored filters allow him to make changes in *relative values.* If you place a K2 (Yellow) filter in front of your lens, certain colors in the scene before you will be recorded on the film differently than if no filter is used.

In the case of a K2 (Yellow) filter the deep blue sky in your landscape will be recorded as a rich gray instead of almost pure white. Any clouds in this blue sky will also be considerably emphasized! (Don't overdo!) The "Wratten Filter Guide" will give you a clear picture of these changes in relative values as produced by the various filters. (Also see chapter on Filters)

Almost all filters reduce the amount of light that can reach the film. It is therefore necessary to increase the exposure time by a given amount. The number by which the original exposure has to be multiplied is called the filter factor. This factor varies with the type of film used as well as with the make of filter.

To obtain the correct filter factor consult your film guide and the information published by the manufacturer of your film.

A K2 (Yellow) filter has a factor of 2 with Panchromatic materials. Therefore, if your original exposure was ½ second, when you use a K2 filter the exposure must be increased to 1 second.

One major reason for using color filters is to aid the film to translate color contrast more naturally and correctly into the black and white contrasts of the photographic medium.

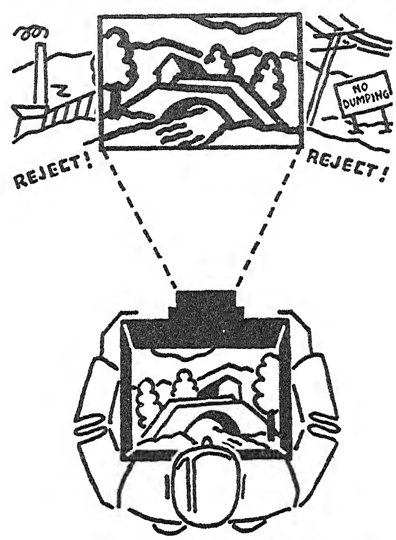
Range Finder Focusing

At the right hand side of the camera frame is the automatically focusing accessory range finder (if the camera is equipped with one). This new method of accurately focusing a camera has made the Speed Graphic infinitely more flexible and easier to operate. Instead of either measuring or guessing the distance between object and camera, or focusing on the ground glass, this new optical device automatically focuses at any distance—from 4 or 6 feet to infinity.

Through the eyepiece near the top of the range finder, a part of the scene to be photographed is viewed. If the camera is *out* of focus, a double image will appear in the small round window of the range finder. (See illustration) By turning the focusing knob this double image is brought either closer together or farther apart. When this double image becomes *ONE* (coincides) the camera is in perfect focus. The range finder on the Speed Graphic can be used with the eye a short distance away from the window.

Important: No double image will be visible if any part of the photographer's right hand obstructs the line of sight of this optical view finder. Notice how low the front entrance window is located. A careless operator can readily obstruct this window!

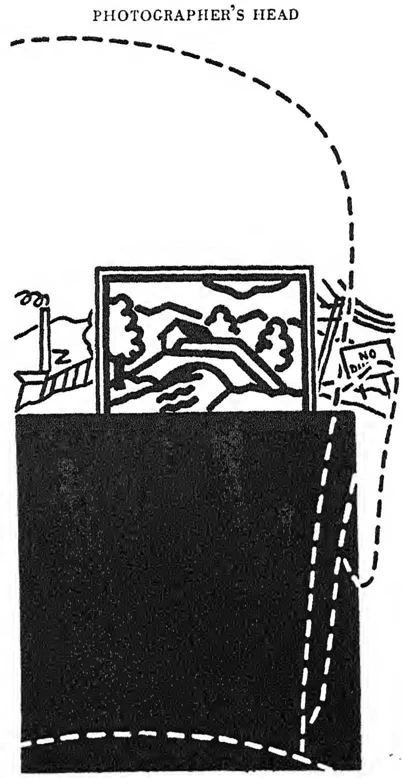
FRAMING THE PICTURE



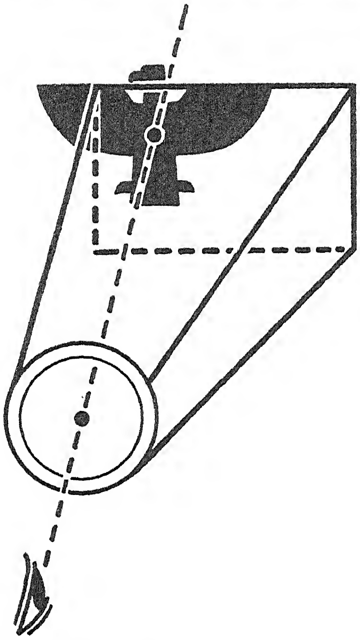
VERY IMPORTANT

SELECT! SIMPLIFY! EMPHASIZE!

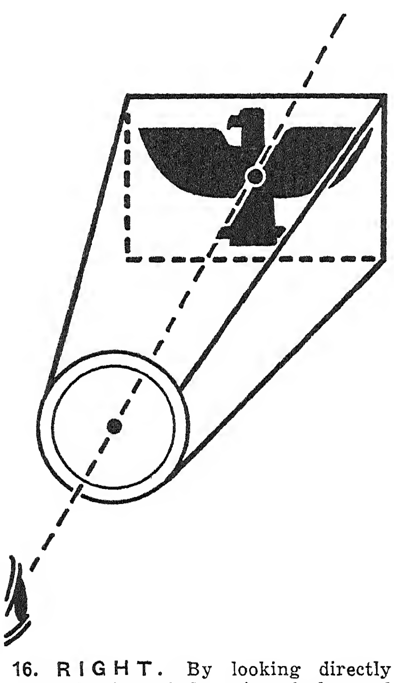
Below . . . LOOKING THROUGH PHOTOGRAPHER'S HEAD



CENTERING SUBJECT



15. WRONG. When looking through the tubular range finder on the Speed Graphic cameras, center the principal subject at the front of the view finder. Small projections on the outer frame make it possible to align subjects.



16. RIGHT. By looking directly through the tubular view finder and placing the image in dead center the same subject will appear in the same relative position on the exposed film in the camera.

Step III

!VERY IMPORTANT!

This is the moment the picture is born!

Select! — Simplify! — Emphasize!

1. Use view finder or ground glass (Reflex Mirror).

TAKE YOUR TIME!

The purpose of the various types of view finders is to enable the operator to judge how much of the subject in front of his camera is being projected by his lens on the film in the camera!

The ground glass in the Speed Graphic and the mirror reflex ground glass in the Graflex are the most accurate view finders. The Graflex type of ground glass and mirror arrangement has the added advantage of projecting the image right side up and visible until the moment of taking the picture. In portrait work and other branches of photography, this is of great importance!

Exactly what you see in the ground glass will also be recorded on the film! Other types of view finders have some latitude on that score . . . the field covered by them varying somewhat, due to factors such as the distance of the eye from the finder, etc. The wire frame type of view finder as found in the Speed Graphic must be used with caution at close working distances.

Parallax may cheat you of a section of your picture! The new telescope type of view finder as now furnished with the Speed Graphic has a manual adjustment for Parallax correction for distances of 6, 8, and 15 feet.

If this view finder is properly used you will have the same image on the film as you saw in the view finder, but, oh, if you should forget to make these adjustments you may find that you cut your aunt's ear off! So "Beware of the Parallax!"

ONE MORE WARNING!

Look straight through your telescope view finder. It is most important when looking through this tube that you see all four sides of the front frame at all times. As soon as you see only 2 or 3 sides it means that you look through the finder at an angle and your eye will see a different part of the screen than your film!

Look at the image that you see in your view finder and try to translate this small colored image into a finished 11 x 14 black and white print, beautifully mounted and hanging on the wall of a salon!

This trick of "seeing" your photograph *before* it is taken will greatly advance your pictorial skill and prevent you from making many exposures when there really are no pictures.

Don't let the brilliant color of the view finder image deceive you!

A monochrome viewing filter enables the beginner to transpose the colored image into a black-and-white image. Example: a red apple

among green leaves produces a beautiful *color contrast,* but as seen by the camera (unless carefully filter corrected) there is almost no black-and-white contrast.

TAKE YOUR TIME

2. Make all your corrections now while placing the composition in the view finder area.

It is so much easier to make corrections now than later. In the darkroom and on the cutting board you can only take things away. You cannot include additional materials (except by certain trick methods).

3. While there are many good books that attempt to teach composition, the beginner's only salvation lies in learning to "see" and apply good taste to his "seeing," and most important of all: "Remain true to his own taste!"

It seems better to have a 50-cent taste that is all your own than a $10 taste that has been borrowed from somebody else!

To insure rapid progress, the beginner should "specialize." Too many beginners are overwhelmed by the tremendous wealth of possible picture material. Select a small section from this endless variety and sink your photographic teeth into it!

Unfortunately, there are no permanently valid rules of pictorial composition. A few general don'ts of composition might be mentioned, but don't mistake these don'ts for what is so often and so incorrectly called the "accepted rules of good composition." There is no such thing! Don't be afraid! Have the courage to experiment! The only standard that can be applied is: "Do you like it?" Remember the great Dutch painter Rembrandt was for many years almost the sole admirer of his own paintings. Composition DON'TS:

DON'T crowd too many things into one picture.

DON'T have more than one point of major interest.

DON'T fail to place emphasis on that point.

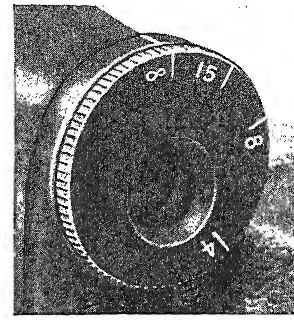
DON'T forget to look at the background. Let it remain "in the background." Many pictures made by beginners are ruined by trees, telephone poles, and smokestacks growing out of people's heads. Before you finally make the exposure stop for a moment and observe what goes on behind your subject. A slight shifting of the camera to the right or left, or lowering the instrument, may mean all the difference between success and failure.

Step IV

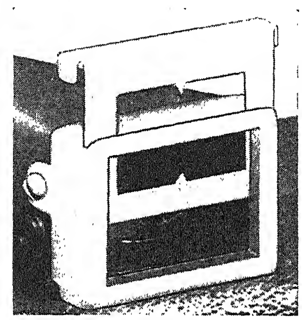
A. To actually put the picture on the film a certain amount of light as reflected by your subject must be allowed to act for a certain length of time on the emulsion.

B. Wind shutter mechanism!

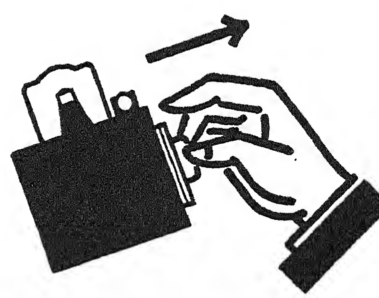
C. Don't forget to withdraw the protective slide that covers the film



17. Rear of tubular view finder showing parallax marking from 4 feet to infinity.



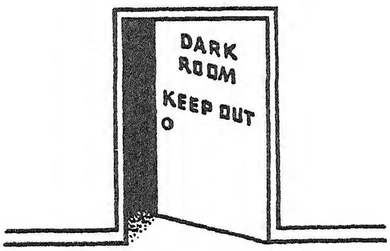
18. Front view of tubular finder showing provisions for interchangeable masks for use with various lenses.

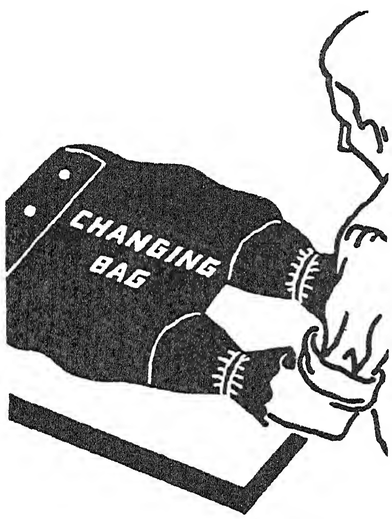


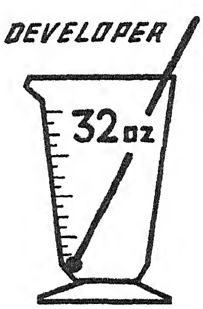
19. TO ACTUALLY MAKE A PICTURE

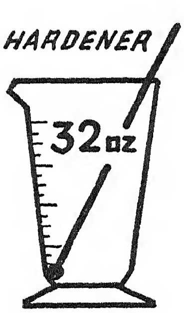
A. Wind shutter mechanism.
B. Pull out protective slide.
C. Set lens diaphragm.
D. Adjust focus.
E. Center image in finder.
F. Release shutter.
G. Replace film holder slide.
H. Change film.
I. Replace lens cap.
J. CLOSE CAMERA.

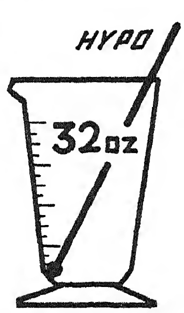
THINGS YOU NEED











in your plate holder, film pack adapter, or magazines. Withdraw the slide gently. (Very important if camera is on tripod!)

D. Releasing the shutter mechanism must be done with great care. Any jerky and abrupt manipulation of either the shutter release (M) or the cable release (E) will result in blurred image. Don't pounce down on the release lever like a hawk on a chicken, but place your finger gently on the release and continue to press down until the mechanism is released (like squeezing the trigger of a gun). Use cable release and tripod for speeds slower than 1/25 second. Don't pull on the cable. Let it bend in a loop!

E. Replace film holder slide in such a manner that you can tell that this film has been exposed! Blackened side of dark slide outward.

F. Replace lens cap and close camera, or repeat steps preparing camera for next exposure.

G. Protect exposed and unexposed films from strong light at all times. A sunbath may be good for you, but it is hard on your photographic equipment!

Step V

STOP—LOOK—THINK

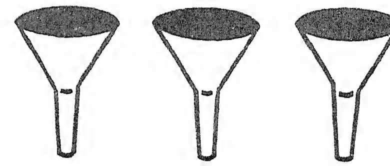
What have I forgotten? It is surprising how easily one can forget to repack part of one's equipment. Better carry good insurance and look around before you leave the scene.

PART II:

The 5 Vital Steps of Developing the Negative

The following equipment and material is necessary to develop and process the exposed film or plate:

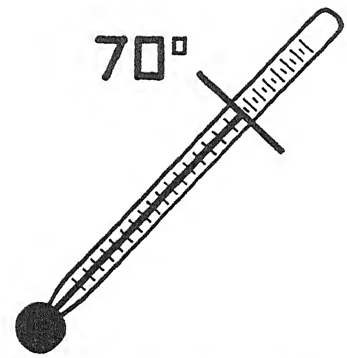
ASSEMBLING EQUIPMENT FOR DEVELOPING FILMS



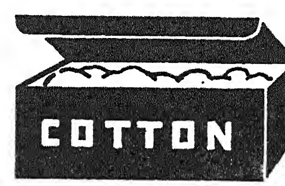
1. *A darkroom* (really dark!) You can't take chances with light leaks; modern fast emulsions are too sensitive. Make test! Place a 5-cent piece on the emulsion side of your film and let it remain there for a few minutes on your working table. If you can detect the coin's shadow-image after developing the film, *the light in your darkroom is not safe!* Make it safe before you proceed. It is better to work with a good changing bag than in a poor darkroom.

   Changing Bag

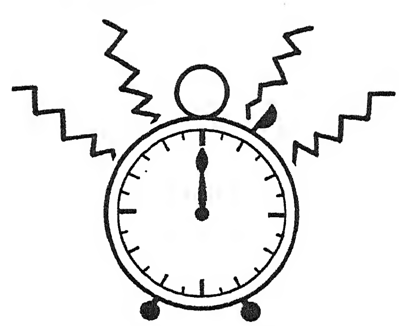
   A changing bag is a light-tight bag made of light proof materials, with two sleeve-like openings into which the hand and the lower arms are inserted, and an elastic preventing light from entering the bag. At the opposite end the bag opens to receive the equipment (film holders, developing tank.) In this light-tight bag, the exposed film is transferred from the film holder to a Daylight Developing Tank.



2. 1 32-oz. graduate for developer.
   1 32-oz. graduate for hardener.
   1 32-oz. graduate for hypo.
   3 funnels, one each for developer, hardener, hypo (Beetle Ware or glass).
   1 accurate photo thermometer, also some stirring rods, cotton, scissors.
   1 darkroom interval timer with alarm.



3. A good recommended daylight developing tank, or three 8 x 10 trays and film hangers (if daylight tank is not used), 6 film clips.
4. The beginner is advised to depend on the recommendations of the manufacturer of his film material regarding developer, developing time, temperature, and gamma. It is wiser to buy the ready mixed chemicals rather than to compound one's own. If you want to mix your own chemicals be *neat—clean—and accurate!* 25 grains in a recipe actually means 25 grains, not 28 or 21. Follow instructions carefully and don't be afraid to discard chemicals when they are exhausted! For further information see chapter on Darkroom Technique. The developer, the hardener, and the fixing bath (HYPO) are now brought to the same temperature.



(continued on bottom of page 13)

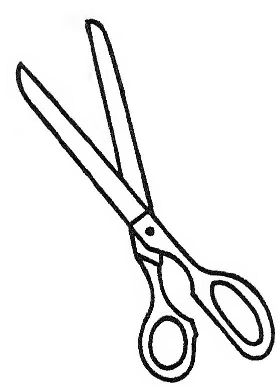
The ABC of Photography

You can read this later, after finishing the main chapter

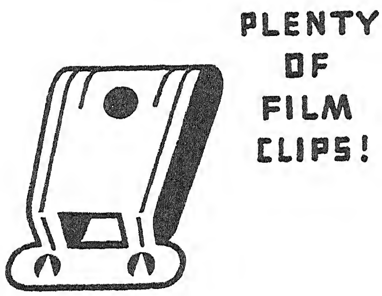
At all times be master of the mechanics of picture taking—when the moment of picture making arrives, you can't afford to fumble with your equipment! Train yourself to a routine.

Before you press the button—hesitate—just for a moment—THINK—LOOK— and COMPOSE, and remember that 50% of composing consists of removing the unsuitable. "BE A GOOD REMOVER."

(continued on top of next page)

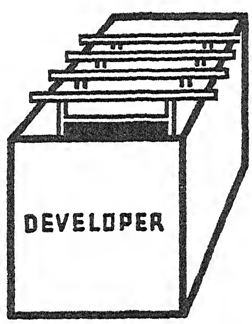


CLIPS AND TANKS



Can you hold your camera steady enough at 1/25 second? Don't fool yourself—convince yourself! Take a shot of a still life at 1/25, hand-held, and one at the same shutter speed on a SOLID tripod. Enlarge both to 11 x 14—and look and weep! But if you have to work with slow speeds, make use of all the known "dodges."

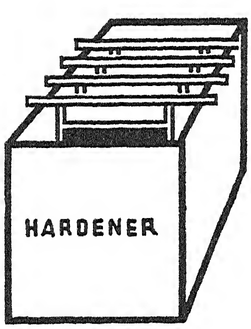
Don't expect "Contact Print" quality in your 8 x 10 enlargements from your small film unless you are willing to take infinite pains—the smaller the size of your negative the more care you have to take—but don't think that you can get careless just because you work with a 3¼ x 4¼ Camera! Unless you use an 8 x 10 camera you better buy-beg-borrow-or-steal a first class 8 x 10 contact print to hang up in front of your nose to show you what "PHOTOGRAPHIC QUALITY" CAN be. And then see how closely you can get to that "quality" with your enlargements! DON'T WORK IN THE DARK! except when you are developing Pan Emulsions. Even then, you should, at least once in your "photographic life," develop a film or plate by inspection.



Enduring values of a photographic picture lie mostly in the choice of SUBJECT MATTER! *WHAT* you photograph is even more important than *HOW* you photograph it! The greatest masters of the lens can impress us, TEMPORARILY, with their great PHOTO-TECHNICAL skills, but the photographs that will have a LASTING appeal are the ones that are the expression of a personal approach to an interesting subject matter!

Focus—Focus—FOCUS!—by all means—and always—FOCUS!

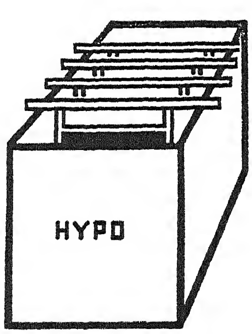
Grain in the emulsion of the negative is not so difficult to avoid. Particular care and cleanliness, and correct exposure (not too full) are as important as the right choice of a true fine grain developer. And if you can get reasonably fine grain, don't spoil it by printing on "fancy" paper surfaces. Rough papers will hide grain and also definition.



Halation—something that used to bother your father a lot when he tried to take a picture of anything that included a direct source of light. It made a great big halo around a simple oil lamp and sometimes the effect was rather interesting, but present day non-halation emulsions are free from that.

Indifferent—something your picture should never be. It is OK to have a bad picture once in a while, but an *indifferent picture* is a mortal sin. When you can't make up your mind whether one of your pictures is good or bad, tear it—quickly into small pieces, very small pieces and throw them into the wind! Never—oh never—try to "fiddle it up" with some fancy printing process, trying to make a masterpiece out of a bad picture!

Jolly—have a good time—don't take photography too seriously, keep a free spirit and a joyous heart. That is the way to make good pictures.



Kodachrome — at present the most successful color emulsion — much better than the color taste of most users. Just because Kodachrome is fairly expensive does not mean that you have to put all the colors of the rainbow into every subject! Have you ever tried to take a subject that appears to be 100% black and white? Try it—you will get a surprise!

Light—Light—LIGHT—the life blood of photography. The humblest subject has *its* glorious moment—in light! Light reveals—light hides—light conveys plasticity—light reveals texture—without light photography does not function. Don't take the first light you find—stick around—see what a motif looks like at sunrise—at noon—one hour before sunset—that's the way to make photography function. Don't take my word for it—try it.

Moment—the right moment—THE moment! In action photography it is *that* moment which is the quintessence of a series of actions. A man, (well, have it your way) a girl—is it the moment she is poised on the edge of the board? Is it the moment she is in mid-air? Is it the moment her body touches the water? Which of these moments you choose is up to you! Just remember one thing—be sure that you are conscious of these facts—and you will do well!

Negative—the heart of the photographic process—your best print can only be a hair better than your negative. A lot can be done in printing, if you know how, but, given a good negative the merest printing tyro can do circles around an experienced printer with a poor negative.

Optics—don't worry too much about it—get the best optical equipment your pocketbook can afford—good lenses are not cheap. They are not easy to make. Do you know what goes into the making of a *good* lens? Mathematicians bent over their calculations for years, lensmakers, glassmakers and chemists. There are lenses that are cheap, and they are! but you *should* know the different characteristics of lenses of various focal lengths. Don't try to make a short focal lens do the work of a long focal lens, and vice versa!

Picture—What is a *Picture*, and what is only a *photograph?* In plain language, a picture is a photograph that tells you something! Tells you what your reactions were to the things before you. Many times a photographer's reaction is purely external. He may have seen somebody else's original reaction to life around him and, if he sees in life a similar "setup" he kids himself into believing that *he found a picture*. But all he saw was somebody else's interpretation of a picture idea. That is what accounts for the thousands of cousins to our original uncle. Don't be a cousin—be an uncle. *(continued on page 14)*

(continued from page 11) **!IMPORTANT!**

FROM NOW ON ALL HANDLING OF THE FILM HAS TO TAKE PLACE IN COMPLETE DARKNESS

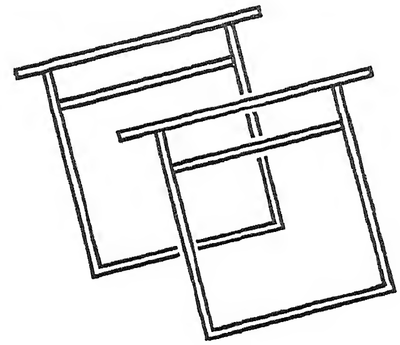
LIGHTS OUT!

1. *In Total Darkness.*
   a. With great care remove film from holders or magazines!

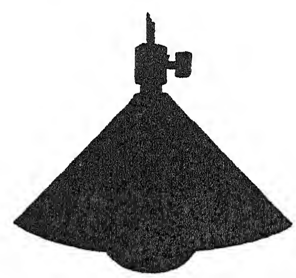
   DON'T TOUCH EMULSION SIDE WITH FINGERS!

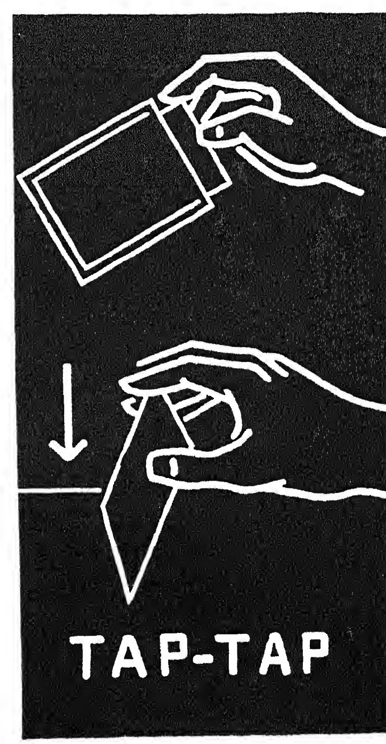
   b. Tap film lightly on table . . . like you do a cigarette . . . to remove dust specks.

SOME FILM HANGERS



! LIGHTS OUT !





FILM DEVELOPING

2. *Place in 70° developing solution.*
   a. Prevent formation of air bubbles by raising or lowering film in developer!
   b. Agitate film in developer constantly to prevent uneven development.
   c. Develop for specific time recommended by the film manufacturer.
3. When bell rings indicating correct time of development, immerse film for a few seconds in hardening bath.
4. Take film from hardening bath. Place in hypo for at least 15 minutes.

GUARD against the forming of air bells or bubbles in the hypo! Move film up and down during the first 2 minutes!

The ABC of Photography

(continued from page 13)

Question—most amateurs are better questioners than answerers! A question should never be a book whereon to hang your own knowledge! Don't ask a question, unless you are prepared to listen!

Reticulation—some horrible skin disease of your emulsion, which it will get if you expose your film to a considerable variation of temperature during development! A severe case of the disease looks like the skin of a rhinoceros, but the mild cases are really much more dangerous—hardly visible—especially on small films, they are sometimes readily confused with lack of sharpness!

Snapshot—any photograph taken thoughtlessly. Many time exposures are only snapshots and many snapshots may be masterpieces of photography. Formerly the term snapshot actually referred to a short exposure of 1/25 second or less. But today, many photographers use it as a term of apology when they say, "Oh, this is only a snapshot!" They really mean, "Don't be too critical of this picture, I took it in a hurry, and therefore am not to be blamed for its shortcomings!" Don't be that kind of a snapshooter. Make short exposures, 1/100, 1/500, 1/1000, but let them all be well considered photographically. Don't make a snapshot synonymous with snap judgment!

Time—Take plenty of time—even to capture the fleeting moment. Devote much time before the moment arrives to planning and preparing, so that you will be ready to do your best. If you find something worth photographing don't be stingy with the amount of time you devote to planning the picture. Good pictures are made *before* the button is pressed!

Underdevelopment of projection prints. The majority of amateur photographers invariably underexpose and underdevelop their prints. Why? To the beginner an overexposed and overdeveloped print seems to him to be a much greater calamity than an underexposed print, and it takes a long time for him to work up sufficient courage to really fully expose a print. Burn up a dozen prints and you will learn how to print in a short time.

(continued on page 17)

LIGHTS ON!

THE THREE VITAL STEPS OF FILM WASHING, CLEANING, AND DRYING

1. *Washing Film*

   a. Wash films for at least 30 minutes in RUNNING WATER.

   b. Guard against films scratching each other in the wash water! Films are best handled during washing while in film hangers or daylight tanks!

2. *Cleaning Film*

   With a tuft of cotton the size of an egg and dripping wet, go over both sides of the film and remove any deposit or scum before hanging the film up to dry!

3. *Drying Film*

   Remove as much surplus water as possible from film by shaking. Hang up to dry in dust-free room. Stray drops of water can be picked up with a pointed end of wet cotton.

   Never dry film too near artificial heat or in direct sunshine.

BE KIND TO YOUR NEGATIVES!

1. Handle them by the edges only.
2. Store them in transparent envelopes.
3. Work out a filing system that is adaptable to your needs!

Too many beginners think that developing one's own film is a difficult and expensive procedure. Far from it, processing your own negatives is in reality the least costly step in making a photograph, and any person that can read, tell time, and temperature, and can follow directions should be able to produce perfect negatives by the "time and temperature method."

Loading the film into the tank and film hangers, and the swabbing off of the washed films are the only operations that require some . . . a small amount of . . . skill, which can easily be acquired with a little practice.

A Few "Don'ts" for the Beginner

DON'T work in an unclean darkroom. If you can't clean up the whole place spread some clean paper over your working space!

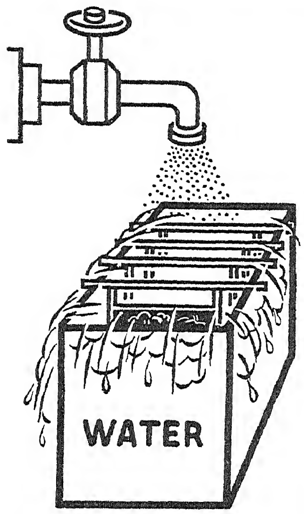
DON'T handle film except by the edges.

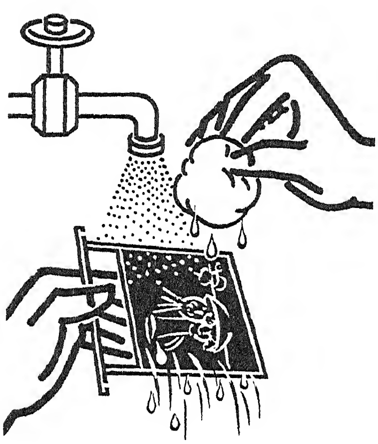
DON'T perform the various steps of developing differently every time. Acquire a definite "routine." Example: Place developer, hardener, and hypo always in the same sequence, in the order in which they are needed.

DON'T spill anything! And don't leave spilled hypo to dry and crystallize.

DON'T be disorderly. Keep everything in the same place (always!).

WASHING AND DRYING





PART III:

Making Your First Print

1. *Contact Printing*—Introduction.

The casual snapshooter who has never made a print does not realize that he misses the most exciting phase of his hobby! Whether you make small contact prints or 16 x 20 inch enlargements, the supreme moment of your photographic career is the day you first see an image appear on your paper! It may be fun to "snap the shutter," and developing your negatives may give you a thrill, but all these operations are but the necessary steps that lead to making the actual "picture."

"Contact Printing" . . . is the making of paper positives the same size as the negative by bringing the emulsion side of the printing paper in actual CONTACT with the emulsion side of the developed negative.

In this form of printing only a very limited amount of correction and improvement of the negative can be accomplished. If you have included a great deal of unnecessary and disturbing picture material your only method to correct this condition is by the liberal use of the cutting knife.

The selection of the right grade and kind of printing paper enables the experienced photographer to get the most out of a given negative!

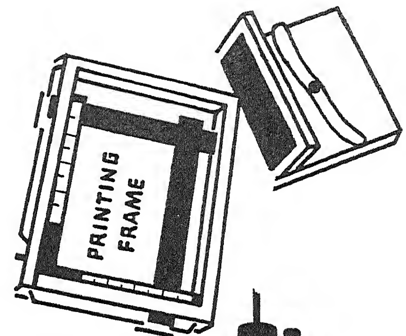
METHOD and MATERIALS

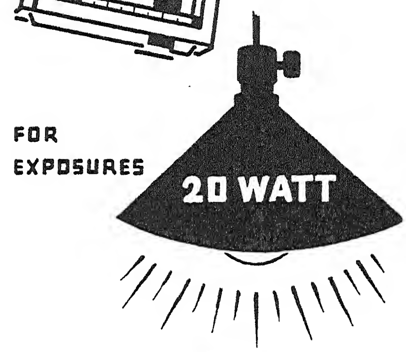
1. Printing frame with adjustable mask.
2. A light source (Mazda bulb).
3. Three trays, larger than the size paper to be developed, for developer, short stop, and hypo.
   A large washing tray or tank.
5. A blotting roll or drying frames.
6. A package each of the four different grades of paper: soft, normal, medium contrast, contrast.

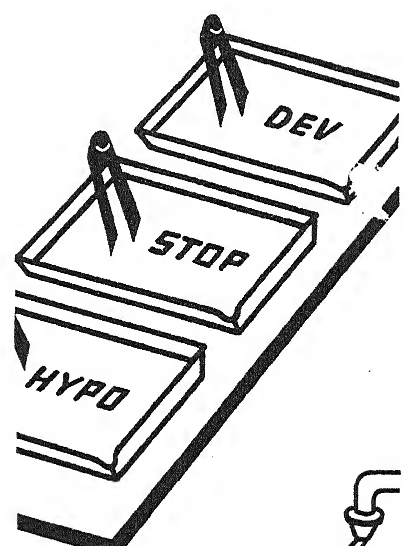
UNDER THE SAFE LIGHT . . . PREPARING FOR PRINTING

PRINTING MATERIALS

7. Safe light — OA for Bromide, Chloro Bromide, Contact papers.
8. Also such items which have already been listed under materials for developing films; i.e., graduate, thermometer, timer, print tongs.







The ABC of Photography

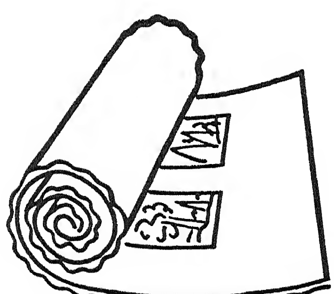
(continued from page 14)

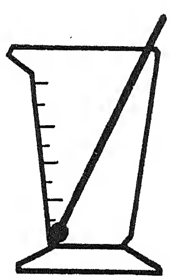
Vibration—the destroyer of good definition. No matter how great the resolving power of your lens is, if it vibrates during exposure, your latent image will be *unsharp*. If you want the maximum of definition, use a *steady* tripod for all exposures slower than 1/100 second. You may be able to hold a large camera steady enough to use a 1/50 or even a 1/25 but negatives intended for enlargements must be 100% sharp!

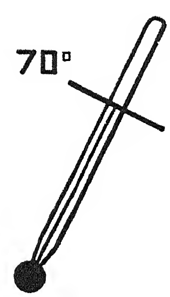
Washing—Wash your films and prints well, especially your prints. It takes more time to remove hypo from paper than from celluloid. Any method of washing that drains off the water from the bottom of the container is to be preferred! When you *think* they are well washed, wash them a little longer and *be sure!*

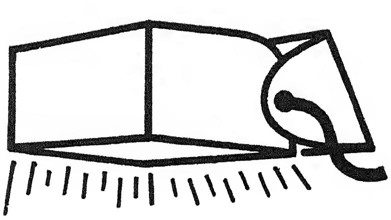
X-XX-XXX speed and more speed on the new emulsions that appear on the market faster than one can test them. These new fast emulsions are a glorious contribution to photography. They convert your f:3.5 lens into an f:2. You have to watch your grain a little more carefully, but most of these emulsions, if correctly developed, have a beautiful scale of gradation. They are soft working. It is good practice to slightly overexpose and underdevelop to hold grain down to a minimum.

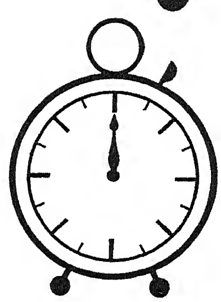
Y-Z The end—let the end of your photographic activity always be a *good print*, and what is just as important, a *beautifully mounted print*. The best photograph lying curled up on the table untrimmed and unspotted does not look like anything, and you *never* know how good your picture is until you mount it! And keep your mounts plain—white and unadorned.



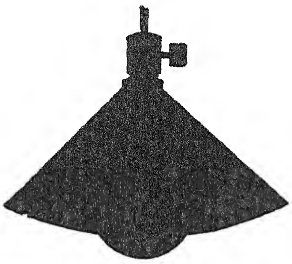


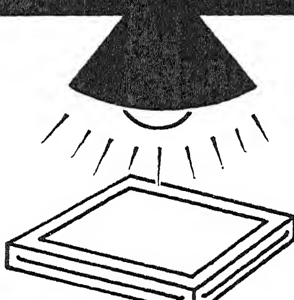


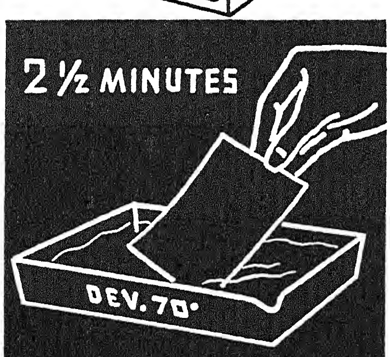




! LIGHTS OUT !







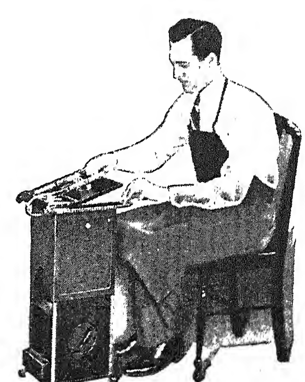
THE 5 VITAL STEPS OF PRINTING!

1. ***Expose.***
   a. Clean work table.
   b. Clean glass of printing frame.
   c. Place dusted negative, emulsion side (dull side) up, on printing frame glass.
   d. Adjust margin of printing frame.
   e. Place printing paper on top of negative with emulsion side down . . . emulsion to emulsion!
   f. Place under printing light . . . turn on light so it shines on glass of printing frame for the right number of seconds.

2. ***Develop.***
   a. Take paper from printing frame and with a soft pencil note length of exposure. Then immerse quickly in developing solution (70°).
   b. Leave print in developer for the full length of time recommended by the manufacturer. If this normal developing time calls for 1½ minutes at 70° . . . every print must receive this standard developing time of 1½ minutes. Stick to that no matter how black your print gets—that simply means that you have over-exposed the print. On the other hand, if the print remains faint and gray no amount of over-development can compensate for under-exposure! And keep your eye on the thermometer! Especially if the darkroom temperature is either above or below 70°.
   c. After exactly 1½ minutes . . . during which time you have gently rocked the developing tray to agitate the developing solution . . . you remove the print from the solution and quickly immerse in short stop for 5 seconds.

3. ***Fix***
   Immerse in hypo to fix the image for from 15 to 20 minutes. If several prints are in one tray . . . they must be moved about to be completely fixed.

4. ***Wash***
   After prints are thoroughly fixed, place them in a good print washer with running water for at least 30 minutes until all traces of hypo have been washed out!



5. ***Drying***
   To dry prints . . . place several on a sheet of plate glass. Squeeze out excess water and with a moist viscose sponge gently wipe their faces,

and lay them either in a blotting roll, on drying frames, or just on a bed sheet. When dry, flatten them out by placing them under a weight. But don't be discouraged if the prints begin to curl again . . . they always will as long as they have only one side covered with a gelatin emulsion! You had better mount the good ones and store the others away! Remember—no matter how bad a print is, it can always be improved by careful mounting.

KEEP THINGS SIMPLE IN THE BEGINNING

To get the "feel" of things, stick to one type of paper, one developer, and keep the light at a fixed distance from the printing frame!

An evening spent in printing *ONE* negative as well as possible will teach you more about printing than making ONE print from each of many negatives.

There is no shortcut to printing skill! Experience and a logical approach to the problem will get you there. BUT! you cannot learn to print without MAKING PRINTS.

Keep your eyes on the second hand of your darkroom clock and be as particular about the accuracy of your print exposure as you *should* be about your film exposures.

Learn to make a "*correct*" print first; then you will soon be able to make a "*good*" print.

IMPORTANT!

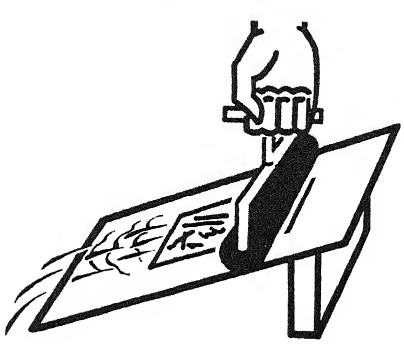
Don't pile prints on top of each other! Fresh hypo cannot reach the emulsion under these conditions and prints will be only partly fixed!

HYPO IS CHEAPER than anything else in photography. DON'T BE STINGY!

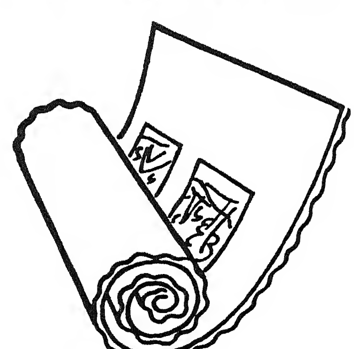
Use large tray for hypo; or better still, use two trays and change prints from one tray to the other.

Hypo is heavier than water; therefore, print washers that draw the water from the bottom of the tank are to be preferred.

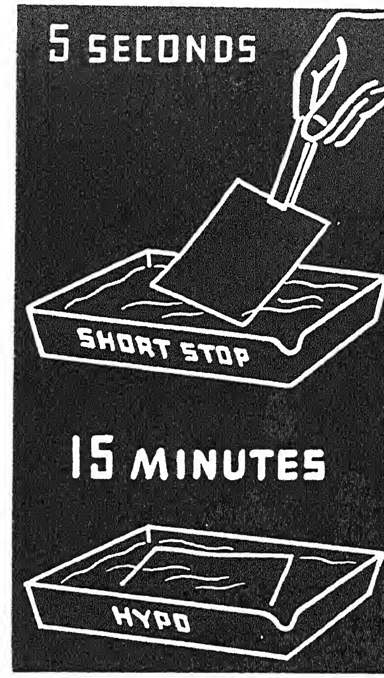
REMOVING SURPLUS WATER



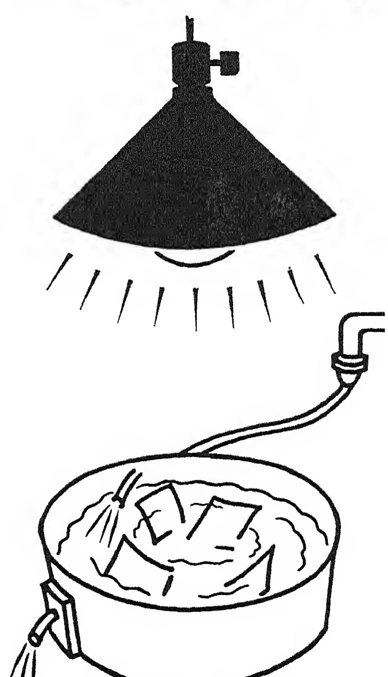
DRYING IN BLOTTER ROLL



DEVELOPER...TO SHORT STOP...TO HYPO

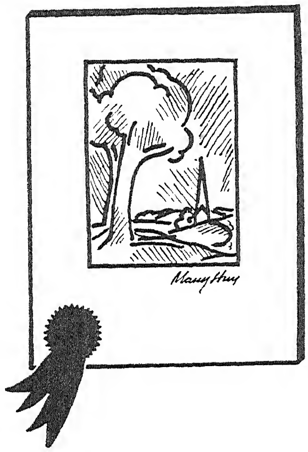


!LIGHTS ON!



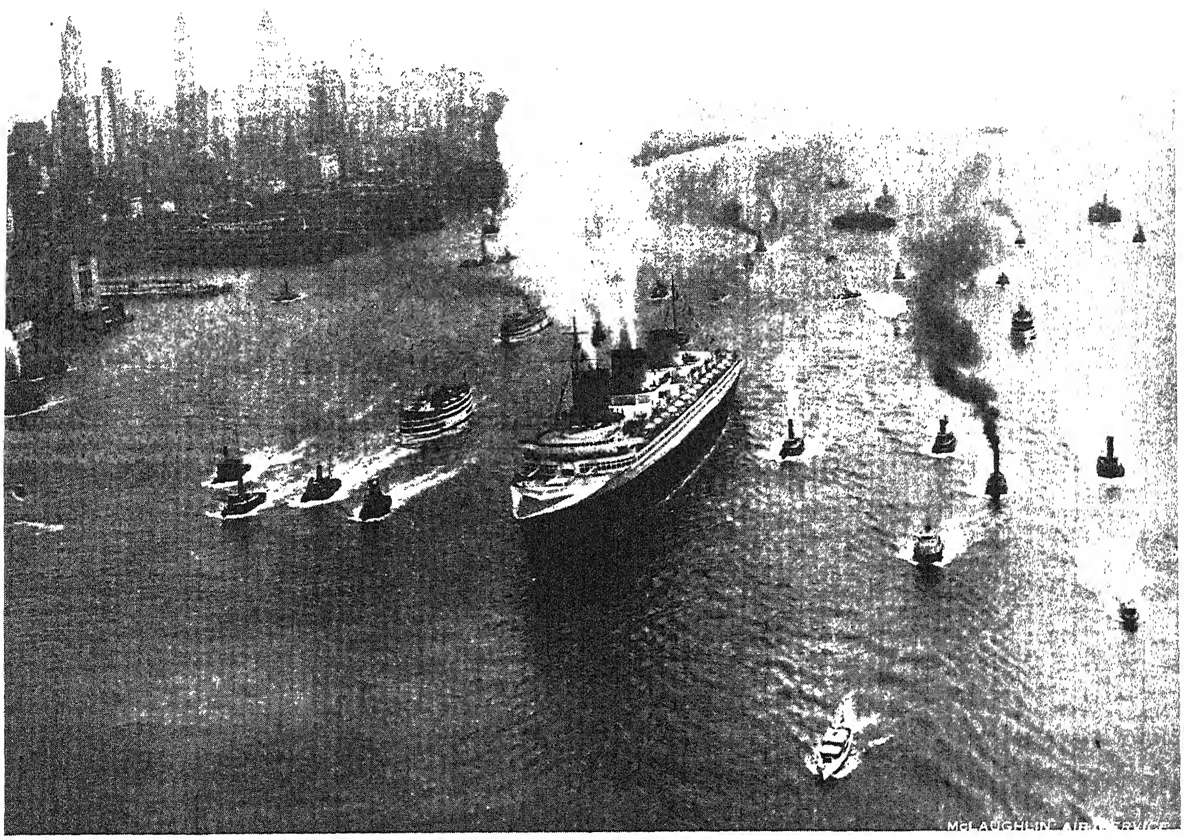
20-30 MIN. RUNNING WATER

THE FINISHED PRINT



Mounting the Print

Not until a print has been well-mounted can the process of making a picture by photography be considered complete. The difference between the appearance of a print as it floats around in the hypo tray and when it is suitably mounted, is enormous! A good mount is simple, of good size, to allow a good proportion of margin—a light matte, just off the white, is to be preferred. Don't mount prints anywhere on the matte . . . make the top and side margins even and the bottom margins about ½ again as wide. Mount your print cleanly with mounting tissue and after the print has been spotted, sign your name (inconspicuously) and then—and only then—can you say . . . I have made a photograph!



20. S.S. NORMANDIE ENTERING NEW YORK HARBOR. By using an Autogyro plane traveling at 8 to 10 miles per hour, photographer Charles H. McLaughlin was able to get this exclusive view of the Normandie on her maiden voyage. 33 other airplanes and photographers were in the air at the same time but only one other photographer obtained this picture because a low smoke cloud obstructed the entire view. Medium light, some haze, at 3 p.m. Focal plane shutter set at 1/160 second, f:5.6, Aero 1 filter, Medium Fast Pan film.

NEGATIVE EXPOSURE AND DEVELOPMENT

H. P. ROCKWELL, Jr.

Existing Conditions

Most photographers can look back on the time when they took pictures by means of a box camera with a single instantaneous shutter speed. In many instances they sent this film to a photo finisher who would then return a print that gave the photographer a record of the scene.

If the results of this sort of photography were wholly satisfactory there would probably be fewer readers for this book, and there would certainly be less of the artistic in photography. It is usually agreed that the object of photography is to produce either a reasonably truthful record of a scene or object, or to produce a work of esthetic quality.

Today photographic equipment and materials are capable of producing unusually beautiful effects and can also reproduce the object that was photographed. Furthermore, for many years before such materials were available beautiful pictures have been made by combining photography with hand methods. However, such work was usually limited to those expert in the particular technique involved.

There has been a great deal written concerning the various hand methods such as paper negatives, hand retouching, local printing, dodging, and the like. In practice, however, there are usually fewer people able to employ these processes successfully than not. Therefore, the effort has been to replace hand methods by mechanical methods which will achieve similar results.

A number of mechanical methods of eliminating the necessity for local printing, dodging, and the like are used at the present time in color photography since it is extremely difficult to dodge three color separation negatives with sufficient uniformity. A number of these methods can be used in black and white photography to place print control in the hands of the vast majority of photographers. In this way the photographer will find it much easier to produce a reasonably faithful record of the scene, and then spend the greater amount of his time concentrating on the artistic aspects of photography.

Building a Photographic Technique

Most photographers who are successful in making pictures have already established a rule of procedure and they are quick to stress the advantages of their methods. Usually they will state that this is the foundation on which successful pictures can be built. They usually agree that if a photographer is not producing the results he desires he should start back at the beginning to be sure that none of the basic principles is being violated.

By way of review, there are really two parts to the production of any photograph: artistry and technique. In the broadest sense the artistry of photography consists of selecting an interesting subject; arranging an artistic composition; and planning an attractive lighting. Of course there are many other well-known principles, but there comes a time when it is necessary for the photographer to stop long enough to expose his film and then process it. It is at this point that the photographer is faced with a mechanical problem which he should solve in a uniform manner in order to be able to reproduce his results. Successful photographers tell us that the following rules are worth remembering at the beginning.

1. Reduce all possible variables in the process to a minimum.
2. Use one set of equipment and one type of material until its use has been mastered.
3. Keep a record of your procedure if convenient.
4. Photographic equipment has some variations, so it is necessary to understand its use as well as possible.

In this last case it seems fair to assume that reliable manufacturers are interested in having their customers obtain the best possible results from the equipment they are manufacturing. To this end they supply instruction data which should be followed until a better method is established by the user for his method of working and his requirements. The result of following these rules can be expected to enable the photographer to make more uniformly excellent pictures. It should also give him the ability to reproduce the original scene with less waste of time and material and fewer disappointments.

Film

It is agreed that no one film can be satisfactory for all photographic work, but in the interest of eliminating variables at the start, at least, it is worth while to seek one film which will handle the greatest number of applications. Manufacturers will supply information concerning the proper film for particular applications.

As a general recommendation the photographer may select a medium fast Panchromatic film to begin with, in order to take advantage of the greatest number of desirable features with the least number of variables involved. In other words, a particular material might be selected if high speed were required, while an entirely different material might be useful to obtain the maximum resolution, or the greatest amount of contrast.

COLOR SENSITIVITY. One of the unseen qualities in any emulsion is its sensitivity to the various colors of the spectrum. The classic example of the importance of color sensitivity comes in photographing an orange on a blue tablecloth. With a color blind (blue sensitive) film the light reflected from the orange would not be recorded, whereas the light reflected from the tablecloth will be fully recorded. Then in making the print the tablecloth would appear white and the orange would appear black. Just the reverse of the way they should appear if we were endeavoring to represent their respective luminosity. It can, therefore, be seen that since a final print must be viewed by the human eye, it is necessary to have a film which sees the various colors in somewhat the same manner as the human eye, so that the proper separation can be obtained between objects of different color in the final print. In general, however, most films are more sensitive to blue than any other color. With some Panchromatic films, however, the maximum sensitivity is sometimes in the red end so that in order to reduce these two extremes to more nearly approximate the human eye a green filter is often employed. Suppose then that the photographer were to photograph the orange on the blue tablecloth with a Panchromatic film and correct filter to compensate for human eye response. The orange would then produce a greater density* for the orange than for the blue tablecloth, and hence in the final print the orange would appear lighter than the tablecloth, which is the way it should look.

The additional advantage of using such a film is that a great deal of control of color response can be had. Suppose for example that a portrait were being taken with Panchromatic material, and it were desired to bring out the red in the face or the lips. By proper selection of a suitable blue-green filter it would then be possible to reduce the red sensitivity of the material sufficiently so that the various reds would appear darker than normal. Effectively then the photographer has turned his Panchromatic film into an Orthochromatic material. In the same way if he intended copying a blueprint and wanted to increase the contrast so that the blue area on the print would be as black as possible, he would use a deep yellow filter to reduce the blue sensitivity, but allow the red and yellow components of the white light from the lines on the blueprint to come through. Thus it can be seen that by adding the correct filter to a Panchromatic material it is possible to suppress or emphasize any band of colors to which the film may be sensitive. Considering this in a slightly different way, the photographer can with the same film have the effect of a Panchromatic material, Orthochromatic material or even a color-blind material.

In this connection the question frequently arises whether or not a person may determine the factor of a given filter by placing this filter over the photoelectric cell of the exposure meter, and basing the camera exposure on the reading so obtained. While this does work out with some combinations of film and filter, it can be seen that whereas the photoelectric cell sees all of the various colors of illumination it does not necessarily see them the same as the different types of films. Hence, unless it has been found to work successfully for your own application it is not recommended as a general practice.

The polarizing filter can be used in this way because it has only a slight color absorption but does suppress certain reflections when placed at the proper angle. It is, therefore, quite satisfactory to place the polascreen over the exposure meter cell aperture and determine exposure in this manner.

GRAININESS. While the question of graininess is usually of greater importance in miniature films than in the larger sizes, there are some instances when it must be considered. In general, the slower the emulsion the less noticeable the appearance of grain will be for a given magnification, and a given degree of development. It should be noted that the greater the contrast of development the more noticeable the graininess will appear.

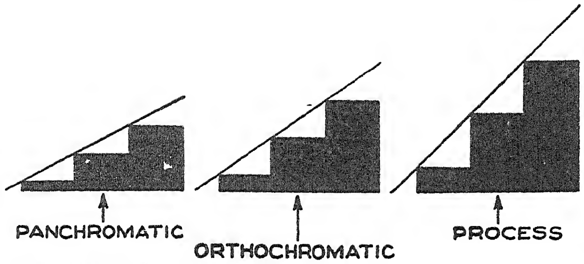
RESOLVING POWER. This refers to the ability of a given film to separate very small detail. Usually the resolving power is expressed in the number of lines per millimeter that can be distinguished in an image. Like graininess the resolving power is dependent upon the contrast of development. but more particularly on exposure. It will usually be found that the best resolving power of a film is obtained with the optimum exposure rather than either extreme.

CONTRAST. While contrast is usually associated with a film it is also connected with the scene and development.

SCENE CONTRAST. It will be shown that there are three types of scenes, the flat scene, the normal and the contrasty scene. These terms refer to the difference between the brightest and darkest object to be photographed in one scene. Hence if there is little difference between the extremes of brightness the scene is said to be flat (low contrast); if difference is great, it is contrasty.

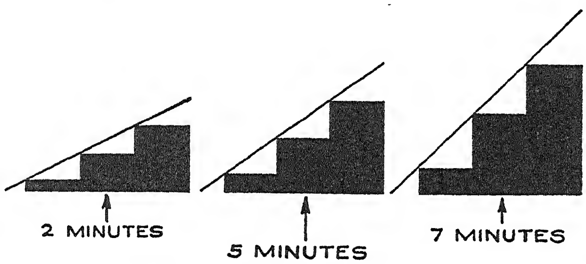
FILM CONTRAST. A film has an inherent contrast by virtue of which it translates the brightness of the image on its surface into a deposit of silver. In other words if it represents a normal scene with a wide difference in the amount of silver deposited between the shadows and highlights, it is considered a contrasty film. If, however, the normal scene is represented by only a slight difference in density the film is said to have a low contrast. Generally speaking slow films (Process and the like) have a high contrast while the faster films have an inherently low contrast as indicated in Figure 1.

*Density is the term used to indicate the light stopping power of a Negative.



1. EMULSION CONTRAST.

Development Contrast. The inherent contrast of a given film can generally be controlled within a reasonably wide range of values by the length of time the negative is developed. Figure 2 shows how a film will increase in contrast with an increase in development time.



2. DEVELOPMENT CONTRAST.

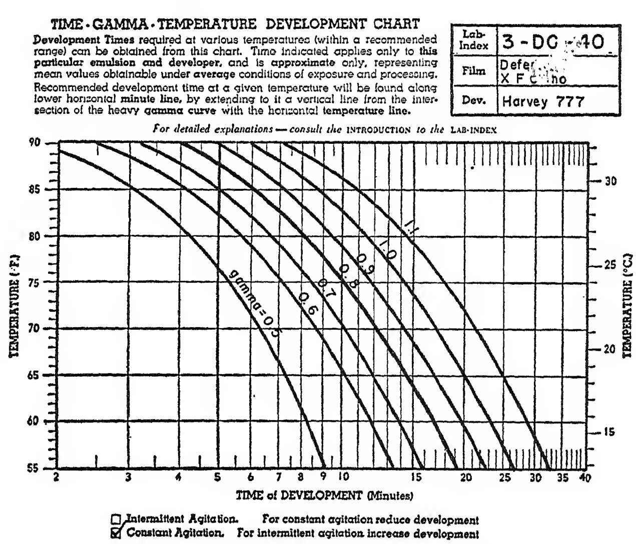
Assume that the brightness range of a particular scene is 1 to 100 units. If a negative were developed and found to have a light transmission range of 1 to 60, then the contrast of development would be 60%. If, however, the negative of the same scene had a transmission range of 1 to 120 the contrast would be 120%. It will be shown later that a numerical measure of the contrast of development is a very practical asset to the photographer and the term commonly used to express the value numerically is *gamma*. For example, the increasing contrast or gamma caused by the lengthening time of development in Figure 2 is represented by the slanting line. Fortunately the mathematical interpretation of gamma is not essential to the production of a satisfactory picture, but the knowledge of its existence and values for our own film and developer is very desirable.

It is safe to say that for the vast majority of photography development should be carried to a gamma of 0.7 to 0.8 although of course there are certain exceptions to this rule. Process film, for example, is usually developed to a gamma of 3.0 and some manufacturers recommend that Press film should be developed to a gamma of 1.2. This latter recommendation however is sometimes given to offset at least partially the fact that exposure conditions are sometimes difficult in Press photography.

Developer. The choice of developer is quite important for optimum results, and it is recommended that the manufacturer's published developer should be used when processing a given film unless special results are required. It stands to reason that some developers work better with the given film than others. Usually the film manufacturer suggests a developer that will bring out the best characteristics of his material with the lowest possible cost. Then, too, more often than not such a developer operates in a relatively short period of time so that the problem of temperature control and agitation is not as serious as it would be for protracted development time. Furthermore, the manufacturer's developer is usually arranged to enable the particular emulsion to be developed to a range of contrast values that will be useful in the field. It is wise at the outset to determine the time-gamma information in order that the photographer will be in a position to determine the length of time of development required to produce a given negative contrast. Figure 3 shows a typical time-gamma-temperature information from a reference manual.*

Latitude. Since the subject of latitude is only important for scenes having a relatively wide range of brightness values, it will not be taken up until the question of such scenes arises later.

Filter Factors. It is wise to determine and record the filter factors for the various filters that will be used with the particular emulsion chosen. A given filter may have one factor for one emulsion and a totally different factor for an emulsion with a different color sensitivity. In general, however, most film manufacturers can supply filter data of this kind to give the best results with their material.



3. A TIME-GAMMA TEMPERATURE DEVELOPMENT CHART . . . one of 150 such charts to be found in the PHOTO-LAB-INDEX.

Emulsion Speed Value. In order to expose any film satisfactorily it is necessary for the photographer to understand the emulsion speed value for the particular film he is using

*The PHOTO-LAB-INDEX by Henry M. Lester; published by Morgan and Lester.

and for his own processing conditions. Exposure meter manufacturers are impartial in supplying the correct emulsion speed value for use with their exposure meters, and for a given set of developing conditions, usually those recommended by the emulsion manufacturer. This, of course, is another decided advantage in using the manufacturer's recommended developer.

Finally the photographer should develop a wholesome respect for the emulsion side of his film and be particularly careful not to scratch or allow dust to collect on it. He should also be particularly careful to see that his safelight is really safe, and if Panchromatic materials are used he will find it worth while to develop in total darkness.

Exposure

Before a photographer has taken very many pictures he soon comes to realize that the correct camera setting will make the difference between a record of the scene and a brilliant full tone print. There are, of course, many advantages to correct exposure of the negative material that more than justify the slight additional amount of time necessary to make the simple measurement. These will be discussed separately in the order of the following list.

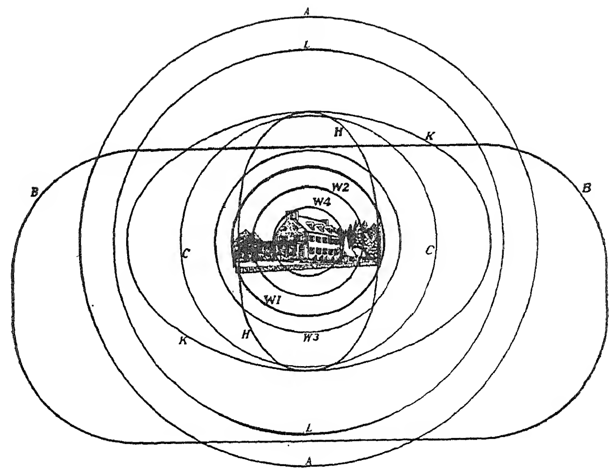
1. You can make more uniform negatives.
2. You can fit the scene into the film latitude and to the paper.
3. You can control the scene lighting.
4. You can obtain the maximum speed from the film.
5. You can simplify color photography.

Exposure Meter. While many different devices have been used from the earliest days of photography to accomplish the above results, it is generally agreed that the photoelectric type exposure meter is most useful for this work because it:

A. Measures a definite area of the scene as shown in Figure 4.
B. Measures colors of the light that the eye doesn't see, but which the emulsion does "see."
C. Can measure the range of light in different scenes.

One of the main considerations in using an exposure meter is to know the area viewed by your instrument.

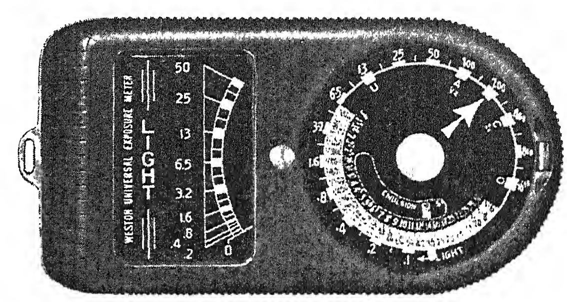
If your exposure meter has an angle of 120 degrees, it would be necessary to go much closer to the object of principal interest in the scene than if your exposure meter had an angle of 60 degrees. With instruments having an angle of 60 degrees it is possible to hold the instrument at a distance, approximately equivalent to the average dimension of the object being photographed. By so doing the photographer can be sure that he is including only the area he is interested in measuring. The reason for this is that all sides of a triangle with 60 degree angles are equal.



4. Area viewed by different exposure meters.

Figure 4 shows the areas viewed by several makes of exposure meters. The small central picture indicates what the camera will photograph, and the black lines around the picture show the area viewed by each of the different exposure meters. Since various meters by the nature of their construction, do cover varying fields, it is recommended that the user determine through use the field covered by his specific meter and then proceed accordingly.

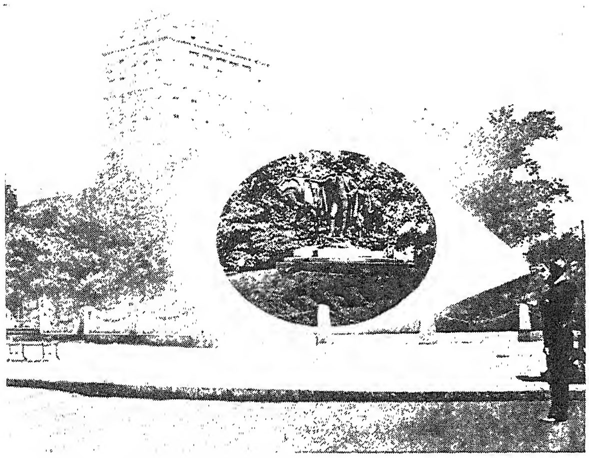
In carrying on our discussion of exposure meters we will select a specific example in order to present actual facts and figures with illustrations. For this purpose we can use the Universal Master Model 715 Weston exposure meter. This type of exposure meter is called Universal because, since its scale is marked in basic values (Reflected light) it can be used for any camera (movie or still), any film or any type of light source. This exposure meter consists of a dry disc photoelectric cell connected directly to a sensitive indicating instrument to measure the light the camera will photograph.*



6. The MASTER Model 715 Universal Exposure Meter.

It should be noted that while the exposure guide dials by means of which the light values are converted into camera settings *appear* slightly different on the Weston Universal Master Meter and the Model 650, such is really not true. Actually the divisions are the same but for simplicity some

*See "The Photronic Photographic Exposure Meter," W. N. Goodwin, Jr. J. S. M. P. E. Vol. XX, No. 2, 1933.



7. CONE OF METER VISION.

numbers were omitted from the Master meter. For this reason in referring to the use of the dial later in this chapter it will be noted that the one used is that shown in Figure 13 simply because all of the numbers are indicated. However, the same methods will apply to all Universal models (617 Types 1 and 2, 650 and 715).

Making Uniform Negatives

For the majority of outdoor scenes where the interest is not centered on any one particular point, there is one basic rule for the use of the exposure meter to obtain a printable negative.

Sight across the top of the meter at the center of the scene half-way between the horizon and the foreground.

This automatically adjusts the meter to the correct angle so that the proper amount of scene will be included and no extraneous material. If, of course, one particular object dominates the scene then the instrument should be sighted directly at that object as shown in Figure 7, and it can be seen that the exposure meter will include only this object provided it is held at a distance approximately equivalent to the average dimension of the object. Figure 7 represents the area covered by a meter the angle of which is 60°. If the meter had a smaller angle it would measure more of the center of interest. If the angle were larger the user would have to walk closer to the scene.

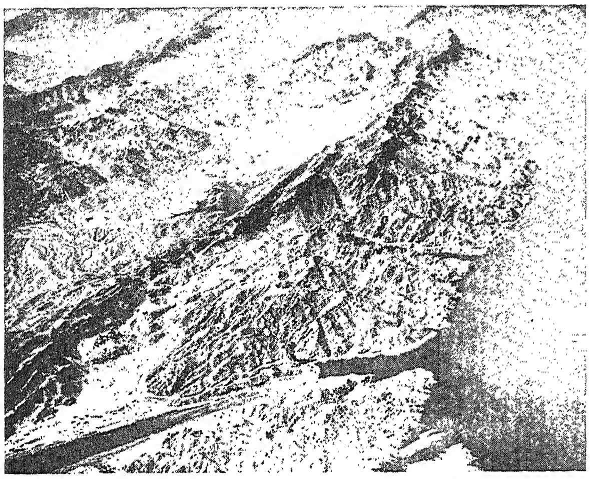
It will also be noted that the exposure meter operates quite similarly to a flashlight in reverse, in that it takes in the cone of light rather than giving out such a cone of illumination. Hence, if the photographer wishes to measure a small object he should go up close to that object just as he would with a flashlight to illuminate it. If the correct emulsion speed value has been employed and the development has been carried out correctly, excellent prints can be made from negatives exposed in this manner.

Some photographers like to expose their negatives to make them as uniform as possible with respect to the shadow densities in order that they will print more easily and be sure of not losing any of the important parts of the scene. It can be understood, of course, that as between the different types of scenes that might be photographed the majority will have a relatively small number of shadow objects in which detail is required, a few will have extremely dark objects and an occasional picture will have almost a complete absence of shadow. As the film looks at these different types of scenes it requires some variation in the exposure to make the minimum negative density uniform on the three different type negatives. Some exposure meters enable the photographer to compensate for these variations in scene contrast. Such models are equipped with exposure guide dials on which have been printed the full range of light values that the instrument is capable of measuring.

Then by means of a normal arrow on the exposure guide dial the average scene brightness of a normal scene (Figure 8) can be converted into the correct camera setting, consisting of the shutter speed and f number of the lens.

Directly adjacent to the normal arrow will be found an "A" position for scenes having an absence of shadow such as Figure 9. This position enables the photographer to reduce the amount of exposure on those flat scenes where he can readily see that there is no need for detail in the shadows. On the other side of the normal arrow will be found the "C" position which is used in place of the normal arrow whenever the photographer realizes

8. A NORMAL SCENE. A Speed Graphic picture made by Frank Scherschel. 1/295 second, f:11, Fast Pan film.



9. A FLAT SCENE. View of the Parker Dam on the Colorado River. Photo by Bureau of Reclamation, Department of the Interior.

that there are important shadows with detail that should be recorded as in Figure 10.

The use of this "C" or contrast position automatically increases the exposure sufficiently to allow the film enough time to record the detail in these shadow areas. It is understood, of course, that such readings are taken from the camera position and that if there be any doubt in the mind of the photographer as to whether he should use the "C" or the "A" positions, then the scene is a borderline case and he will find that the normal arrow will produce a satisfactory negative.

Special Cases

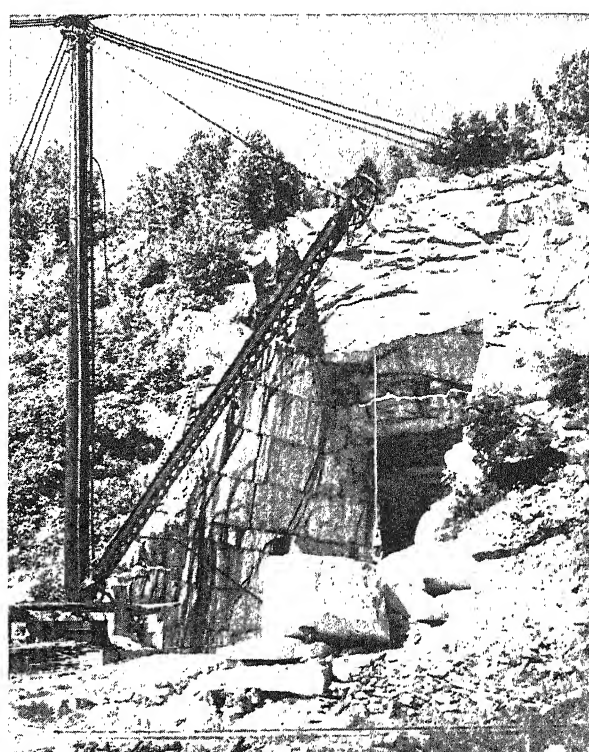
CLOSE-UP READINGS. When the scene is relatively small or a single object dominates the interest, it is wise to approach that object and take a close-up reading. By so doing the optimum exposure is given to the object of principal interest, and the latitude of the film will take care of the various other objects in the scene. In outdoor sunlighted portraits of people the photographer can take a reading from the back of his hand rather than taking time to go up and read the face of the individual in the picture. The only caution in so doing is that he be careful to place his hand in a similar position with respect to the sun that the subject face will be found, and to be careful not to cast a shadow on the hand with the meter.

If the exposure meter in use has an angle of view of 60 degrees or less it should be held at the same distance from the subject being measured as the average dimension of the subject. By so doing it will be possible for the operator to include only that area in which he is particularly interested. For instance, if the average dimension of the object is one foot then the instrument should be held one foot away and so on.

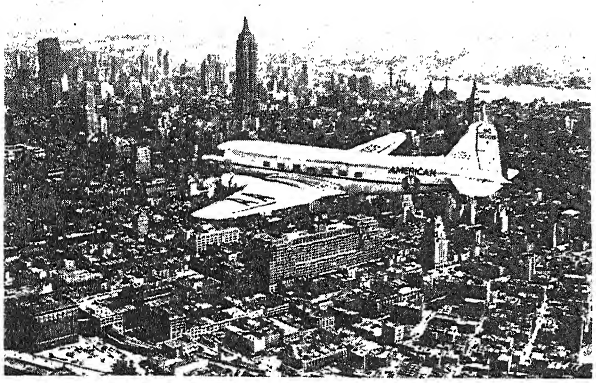
CANDID SHOTS. An exposure meter can give you the correct camera setting in advance for candid action pictures in order that the camera may be adjusted before the action takes place. In the case of athletic events, speeding trains, racing, or similar scenes one should aim the exposure meter at the spot where the action will occur, because of course the object to be photographed will be illuminated by the same sunlight and although there may be some slight difference in reflection coefficient of the object, it will probably be well within the brightness latitude of the film, and since the landscape will be exposed correctly the principal object should also be exposed correctly.

PICTURES FROM AIRPLANES. Airplane pictures as shown in Figure 11 are usually interesting because of the large area that can be covered, the beautiful cloud effect that can be obtained and the unusual patterns that are frequently found in the landscape.

While the exposure meter still sees the light that is to be recorded by the camera, the instrument should be aimed at the ground if possible. In some of the larger transport planes it is extremely difficult to sight the instrument directly to the ground without encountering a part of the wing, or including part of the window frame from the inside of the cabin. In such cases it is desirable to sight the exposure meter at the horizon, and use the C position to give the necessary amount of shadow detail. It should be remembered, of course, that direct air wash from the propeller can cause a distortion similar to the effect of heat rising from a hot pavement. If pos-



10. A CONTRASTY SCENE. A photograph with extremes from pure white highlights to the black interior of marble quarry.



11. A PICTURE FROM THE AIR. See text for aerial exposure information. Photo from American Airlines.

sible it is desirable to avoid taking pictures through the air stream.

UNUSUAL LIGHT CONDITIONS. Light in the rarefied atmosphere of high altitudes usually contains an excess of ultra violet. While this condition is very deceiving to the human eye it should be remembered that the response of the photoelectric cell in the exposure meter and the photographic film is very similar. Hence, the photoelectric cell is able to see this ultra violet illumination which the human eye cannot. Another condition occurs with very early morning and late afternoon scenes, where there is a large percentage of red in natural illumination. Both of these unusual light conditions are automatically compensated when the exposure meter is used and correct exposure results.

BACK-LIGHTED SUBJECTS. When back-lighting is used, such as Figure 12, the meter should be held close to the subject to include only the light the camera will see, rather than the light coming from the source.

INTERIOR PICTURES. It is much simpler to make indoor pictures since the introduction of Panchromatic film, Photoflood and Photoflash lamps. While Photoflash lamps discharge too rapidly for the exposure meter to be useful as a measurement, the meter can be used quite easily with Photoflood or Mazda lamps.

Of course, the shadow areas encountered indoors are likely to be rather large in comparison to the entire scene except in well-lighted studios. When the scene contains these large shadow areas the exposure meter reading should be taken close to the principal object rather than at the camera position. Thus large dark areas will not be allowed to form a noticeable percentage of the reading and result in a lower reading than normal. This would of course cause a tendency toward a dense negative.

FLUORESCENT LIGHTING. A new light source is being used in photography at the present time. It consists of a tube from about one to four feet long, the inside of which is coated with a fluorescent substance. When ultra violet radiation strikes this coating a visible radiation is produced. By selection of a suitable coating material the effect of daylight is created. Hence in using an exposure meter to measure a scene lighted by this type of light the same results can be expected as if the scene were lighted by daylight. Also if the daylight emulsion speed setting is used with the meter excellent negatives can be made.

VERY LOW LIGHT VALUES. Inside a very dimly lighted church or museum it may occasionally be found that the general illumination will be too low for a satisfactory exposure meter reading. Under this condition a time exposure is usually required and this makes the picture difficult if there are any moving objects. When a time exposure can be taken the camera setting can frequently be determined by the use of an artificial highlight. It is often possible to place a clean white handkerchief or paper near the important object just long enough to take a reading from the white area. Effectively this amplifies the meter reading three or four times. The white object must then be considered as a brightest object in the scene. The correct exposure will be obtained by placing the "C" or "O" position on the universal meters opposite the reading thus obtained.

12. A BACK-LIGHTED SUBJECT. Light source comes through doorway at 7 a.m. 1/50 second, f:8, Medium Pan film using 1A Graflex. Lloyd G. Miller Photo.

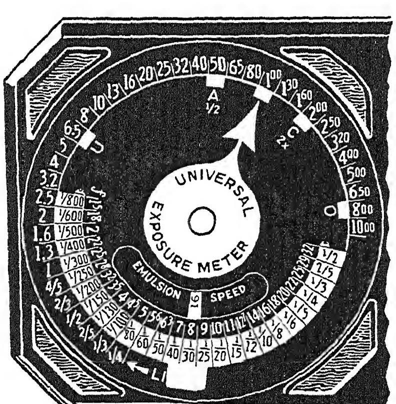
Copying or Closeup Work. There seems to be some reluctance on the part of certain photographers to making copies. Whether it is a sheet of printed matter or another picture the readings should be taken close to the copy board, being careful not to cast a shadow on the subject. In this way the exposure value depends on the brightness reflected from the sheet of paper being copied, rather than the brightness of the copy board itself. It is well if the copy board is large enough to take several readings at various points to see that the illumination is balanced and will not cause dark spots on the copy.

Tests have shown that there is very little difference in the amount of lighting reflected from a plain piece of writing paper and one well covered with typewriting. Sometimes the object being copied is so small that it is difficult to obtain a reading without casting a shadow on the subject. The best substitute is a piece of white paper to take the reading. Using the "A" position the correct exposure may be obtained. Also the film should have a high inherent contrast to give good separation between the black and white. If, however, this is not possible the development time should be increased to build up the contrast.

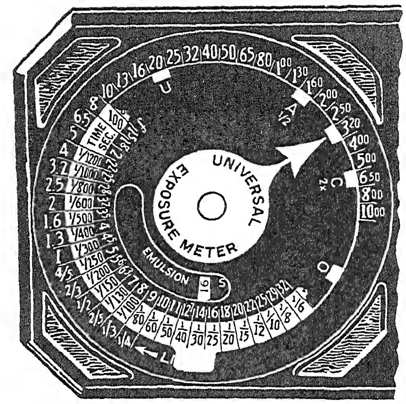
When making copies it is well to remember that the aperture markings on a lens are true only when the lens is working at or near infinity. Thus when the lens is racked out to twice its focal length the aperture is really two stops smaller than marked, and a correction should be applied.

Compensating for Bellows Draw

It is possible to use the exposure guide dials on the universal exposure meters for making this correction in the following manner. Suppose the film you are using has a Weston emulsion speed value of 16 and the object being photographed gives an average brightness reading of 100. It might be possible that under these circumstances you would select the camera setting 1/100 of a second at f:4.5 from the exposure guide dial, as shown in Figure 13.



13. THE UNCOMPENSATED METER SETTING.



14. THE COMPENSATED METER SETTING.

Let us assume, then, that the particular lens you happen to be using has a focal length of 8 inches for the infinity setting. Remembering the setting just obtained on the exposure guide dial, you would place 8 on the f scale above 1/100 of a second on the shutter speed scale. Then if the bellows draw were 14 inches, you would use f:4.5 as originally decided with a 1/30 of a second rather than 1/100 of a second to compensate for the change in aperture of the lens. This 1/30 of a second will, of course, be found under 14 on the f scale in Figure 14 which corresponds to the bellows draw in inches. The same thing would, of course, apply to lenses of other focal lengths.

Special Lenses. The f or aperture numbers ordinarily do not differ with variations in focal length on different lenses when each is focused on infinity. In other words f:8 should gather the same amount of light whether a telephoto, normal, or wide angle lens is used. Hence, once you have established the correct f number and shutter speed for a given scene it is fair to expect the same negative appearance regardless of the focal length of the lens.

Basic Development

There are, of course, a number of exposure controls that can be applied to photography with an exposure meter which makes for improved prints, but before taking up these special cases it seems logical to consider the fundamental development procedure required for the general work outlined so far.

The manufacturer's recommended developer should be used at the outset unless there be some particular reason for choosing a special developer. Since a sufficient quantity of developer for tray development costs only a few cents, it is well worth while to use it once and then discard it in order that its developing efficiency be not destroyed by oxidation. On the other hand, if a deep tank is used it should be covered so the air cannot get at the developer too easily and cause rapid oxidation. Further-

more, the recommended developer usually gives a wide range of control of gamma and develops in a relatively short time. This, of course, reduces the problem of temperature control and agitation. Room temperature will have less effect on a developer in 5 minutes than in 25.

Since most negatives will ultimately be printed on paper it is well to plan the development to produce negatives that will fit existing grades of paper satisfactorily. Consideration of all the factors involved will show that optimum results can be obtained by developing the majority of negatives to a gamma between 0.7 and 0.8. Once this becomes standard the difficulties can be reduced quite materially.

It is well to remember that there is a very close relation between exposure and development, but of course their absolute functions are quite different. In other words, while the correct combination of the two will produce negatives that will enable the photographer to use the full tone range of the positive paper, the one cannot be used to compensate for errors in the other. If the best print is to be made, one cannot expect to use improper exposure and then compensate by under or over development, except within extremely narrow limits. As a working rule the exposure controls the density of the shadows, while the developer controls the density of the highlights. The difference between the two densities controls the grade of paper on which the print is made.

Hence, for a sufficient exposure to give shadow detail on a particular scene, a short development will require that the negative be printed on a hard paper. On the other hand, under the same conditions a longer development will require a soft paper for the same scene. Thus the photographer's aim is to give sufficient exposure to hold detail in the shadows, and just enough development to produce highlights strong enough to print on a normal paper. By so doing the full range of detail can be recorded from the shadows up to the highlights.

The photographer is now ready to develop his negatives that have been exposed in accord with the foregoing suggestion. For the purpose of illustration it is assumed that the exposures have been made on a Panchromatic film and that the developer is mixed and at the proper temperature. Before beginning the development the length of developing time should be determined from the time-gamma table that was already obtained from the manufacturer or in PHOTO-LAB-INDEX. Suppose that for the particular developer in question which is to be used at a temperature of 70° F. the time-gamma table shows a value of 8½ minutes for a gamma of 0.7, and 10½ minutes for a gamma of 0.8. It would be wise to develop to 9½ minutes to be within the two limits. Care should be taken to follow the recommended agitation that the manufacturer specifies to obtain the best possible results.

After the negative has been fixed, washed and dried, it is ready to be printed. A few test prints will indicate the grade of paper on which various negatives should be printed. A good rule to be followed is to see that while the highlights should be kept white, there should be enough tone in the highlights to produce modeling in the print. A good solid black should be visible in the shadows without blocking up the detail that appears on the negative. Probably the majority of negatives will print satisfactorily on a normal grade of paper if the exposure has been correct, and only the short range scenes or long range scenes will require harder or softer grades of paper, respectively. Therefore, if the majority of the negatives are printed on normal paper it is fair to assume that the development time has been correct, although it is well to shorten the development time if it is necessary to dodge in the highlights of most of the negatives or print them on soft paper.

Over development should be avoided by all means because in addition to the difficulty of having to dodge the highlights and contending with a greater amount of graininess, the actual film latitude is reduced.

Fitting the Scene into the Film Latitude

It has already been shown that the majority of scenes to be photographed require no special exposure technique other than the few simple rules suggested in the section titled "Making Uniform Negatives." Occasionally, however, a scene will be encountered where the range of brightness values will be considerably greater than normal, or where special emphasis must be laid on the shadow rendition or highlight rendition. While such scenes are not common, they take on an unusual importance when the photographer is faced with the necessity of reproducing one. In such cases it is necessary for him to know the relation between the latitude of the film he is using and the range of the particular scene being photographed.

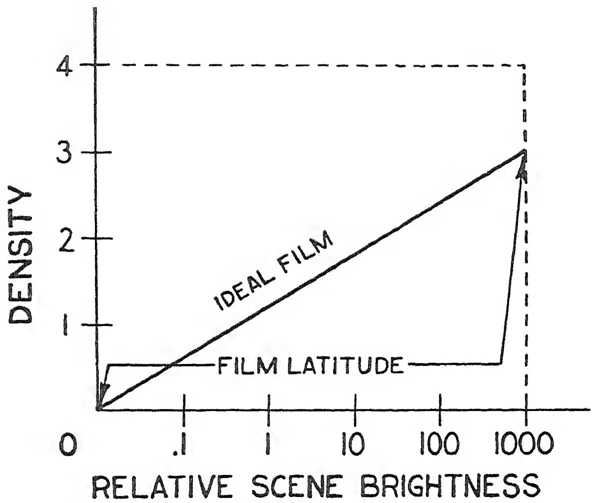
In referring to the latitude of a film it will be understood as the ability of the film to record bright and dark objects and still differentiate between each intermediate tone in the scene. Expressed numerically it is the ratio between the brightest and darkest object that can be recorded with reasonable fidelity.

An ideal film is one which would record very dark objects with a given density, and then show a uniformly increasing density for every brighter object. Figure 15 shows such an ideal film with the densities recorded by a straight line.

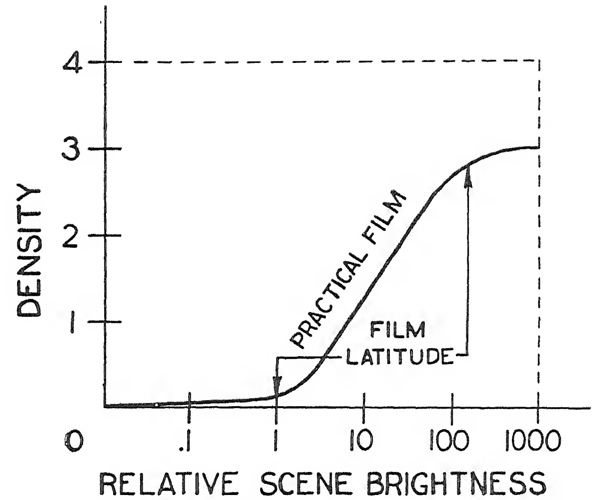
From the figure it can be seen that such a film would have a tremendous latitude and for most scenes there could be no error in exposure.

Figure 16 shows that the useful range of brightness forming the latitude of the majority of practical films (not color) is approximately 1 to 130.

Beyond the lower and upper limits marked by the arrows in Figure 16 the graphical representation of the practical film flattens out in such a way that even though the brightness difference of two objects differs considerably they would be represented on the film by nearly the same density. When this is the case the paper on which the print is made is unable to separate these very similar densities sufficiently to make them simulate the original scene.



15. THE LATITUDE OF AN IDEAL FILM.



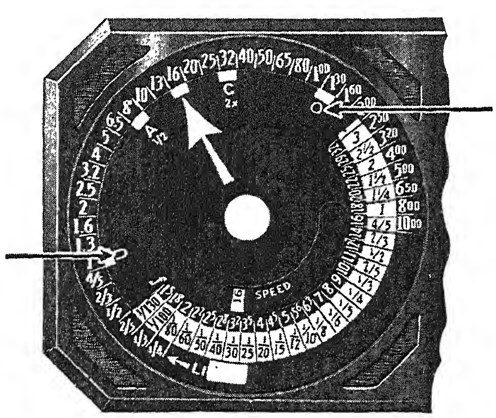
16. THE LATITUDE OF A PRACTICAL FILM.

This effect can be shown in a very practical manner by simply photographing a scene correctly and then purposely under exposing it considerably. The result will be that in making the print it becomes extremely difficult to separate the objects in the shadows from one another. It is therefore worth while to remember that the *wider the range of brightness values in the scene the more critical the exposure becomes.* If the photographer expects to hold the detail in the shadows and still keep modeling in the highlights, each extreme must be measured separately.

Since it has been shown that the useful latitude of the great majority of films is about 1 to 130, these limits have been applied to all of the universal type exposure meters in order that the photographer will have the film latitude available for ready reference.

Figure 17 shows that the arrows point to the "U" and "O" positions on the exposure guide dial, and that the range of light values between the two is 1 to 130.

This means that when the correct emulsion speed value is set in the little window provided for that purpose the photographer can expect sufficient density difference on the negatives to make a satisfactory print for any object whose brightness values lie within the "U" and the "O" positions.



17. THE FILM LIMITS (1 to 130).

With most scenes this problem is not important because if the brightest and darkest objects in these scenes are measured, it will be found that the range between them is sufficiently short to enable them to fit into the film latitude with no special manipulation. However, when the photographer wishes to be sure of a pleasing rendition on a special subject, he should go close to the brightest and darkest object in which he wants good detail and measure the light reflected from those objects alone. Figure 18 is a typical scene where this method proves very useful. In this case, which is typical of many, it will be noted that the brightest object is in direct sunlight, while the darkest object is in the shade of the umbrella, and this greatly expands the normal range of brightnesses in the scene.

It can be seen that even a slight variation in correct exposure on an extremely wide range scene of this kind can cause poor results, either in the shadows or in the highlights. In this case, while the brighter objects are correctly exposed the darker objects that happened to come below the "U" position on the exposure guide dial were recorded on the flat portion of the characteristic curve below the arrow corresponding to a scene brightness of 1 (See Fig. 16). Hence, since the film was unable to differentiate between the darker objects they lack the brilliance that is normally expected from photography. In contrast to this, when the exposure was properly balanced between the "U" and the "O" position, more of the darker objects were correctly exposed and the print was able to show much better separation in the shadow areas as can be seen in Figure 19.

Hence, to fit this or any similar scene into the range of the film; *measure the brightest and darkest object in the scene and balance the "U" and "O" positions as near these extremes as possible.*

To illustrate this rule in the case of Figure 19 the exposure meter was held near the dark area under the umbrella and then near the bright pocketbook. The readings were 2 and 400, respectively. In setting the exposure guide for best results the "U" position was placed one division above 2 and the "O" position came one division below 400. Now it can be seen that while we still fail (because of the limited film latitude) to hold all of the detail in the shadows and in the highlights, the overall result is much more satisfactory than before.

In a similar manner, had the readings been 5 and 160, respectively, the same setting would have been used and the "U" and "O" positions would still be balanced an equal number of blocks or spaces from the scene brightness limits and the full range of brightness values in the scene could have been recorded.

Fitting the Wide Range Scene to the Paper

In other words, there is quite a marked difference between the exposure range of a negative material and the exposure range of a paper. Figure 16 showed that the majority of films were able to reproduce brightness values from 1 to 130. If, however, the same curve as Figure 16 were drawn for a typical positive paper (Grade 2, normal) the light values that would be required to show the full useful exposure range of the paper from a faint gray to a black would be not 1 to 130, but about *1 to 12.* This shows quite clearly the reason why dodging is frequently necessary. In other words if the transmission range of the negative is much greater than 1 to 12 a straight print will show either blocked shadows, flat white highlights or a combination of both, if printed on normal paper.

The usual method of avoiding this trouble is to hold back the light falling on the shadows until the highlights have had time to print in or if possible use a soft grade of printing paper. If a large number of prints are to be made from such a negative it is usually necessary to reduce the density range of the negative chemically or by means of a suitable dye. Either of these expedients is troublesome and *additional* work that can frequently be avoided or at least minimized by planning the development to compress wide range scenes.

Take Figure 19 as an example of this. It was shown that the range of brightness values was 1 to 200. Now if the negative were made to reproduce this same range of transmission values there is no ordinary paper available that would reproduce it satisfactorily.

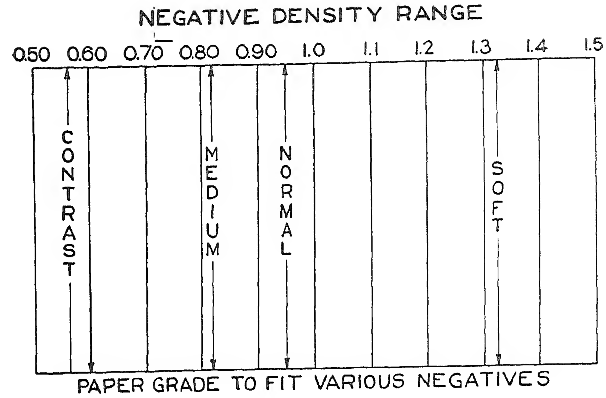
Therefore, in order to make the range of the negatives similar to that which the paper can handle, it is necessary to compress the scene during the process of development. This process is analogous to pouring water from a pail into a small-

18. Example of a WIDE RANGE SCENE.

19. Photograph with correct balance within film limits.

mouthed bottle. In order not to spill any of the water a funnel is used and if the bottle has a sufficiently great volume it will ultimately take up the entire contents of the pail. Carrying the analogy back to photography, the funnel corresponds to the process of developing, and the amount of compression of the scene that is done in developing depends on the development contrast (gamma). Hence, while it is possible to expose the scene correctly and record all the brightness values on the straight line portion of the film characteristic, this effort will be completely lost if the development is carried so far that the range of negative densities is beyond the capability of the photographic paper.

To take an extreme case as an example, suppose we intended photographing two scenes, one with a brightness range of 1 to 4, and the other with a brightness range of 1 to 100. It may be further supposed that the only grade of paper available is one that requires that the difference between the maximum and minimum negative density be 1.0 (this is equivalent to a light transmission ratio of 1 to 10). It is quite clear that if both of these negatives were developed for the same length of time, the range of negative densities would be entirely different for both scenes, and either one or both might not fit on the prescribed type of paper. On the other hand by controlling the development the very short range scene can be expanded and the long one can be compressed.



20. FITTING THE NEGATIVE TO THE PAPER. Slight difference may be noted between a diffuser and the condenser enlarger but the same theory applies in both cases.

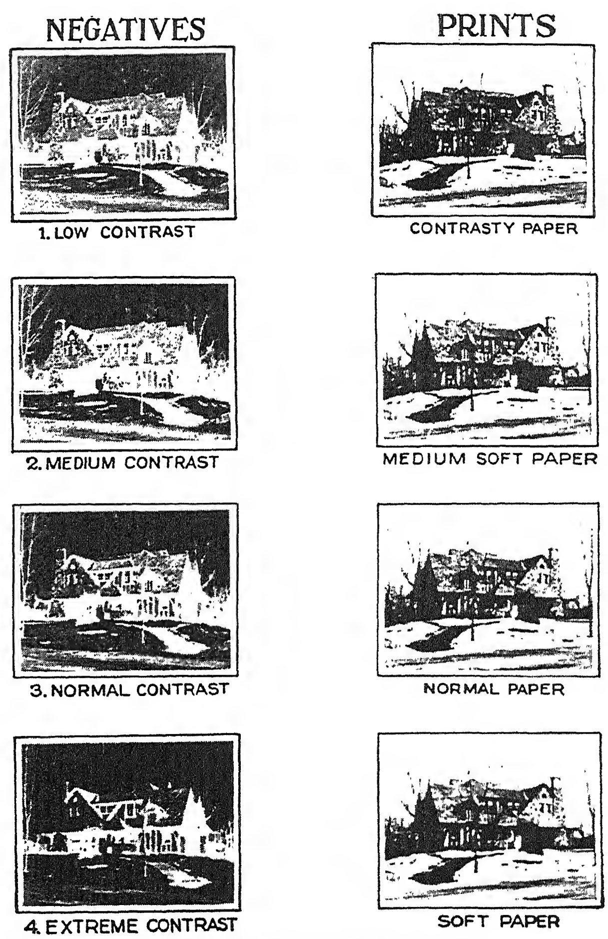
Planned Development. It is really no more difficult to plan negative development to fit the particular grade of paper available, than to develop at random, because the same number of steps are involved in the development in either case.

The advantage of planned development, however, is that one may be sure of the optimum negative for printing on paper. Such a negative will require a minimum of retouching or print control to make a print with the full tone range of the paper.

Fortunately the photographic paper itself is one standard for the optimum negative that is impartial, and not based on personal opinion. The paper is therefore used as a criterion of the negative.

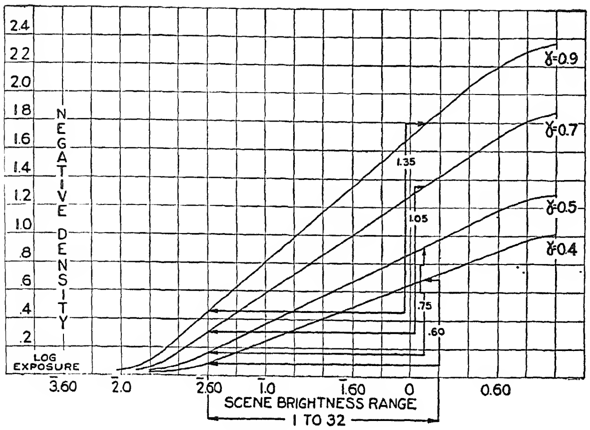
In making any reproduction of a solid object on paper it is necessary for the photographer or artist to use a series of tones. After all it is necessary for him to attempt to portray a three-dimensional object on a two-dimensional or flat piece of paper, and this means that he is forced to use every half-tone available to show the protruding and receding planes in the object. In order then to make full use of these tone values and because most photographic papers are limited to tonal differences of 1 to 40 or less, none of these tone values should be sacrificed. Of course, if the scene being photographed had a range of brightness that is shorter than the tone range of the paper, then the sacrifice should of course be made in the interest of faithful reproduction of the scene.

However, pictures that have only a small brightness difference are quite rare in nature, and are usually not as appealing as those with a somewhat greater inherent contrast. Since this is the case it is almost always desir-



VARIATION IN CONTRAST

21. By selecting the proper contrast in printing paper, successive prints can be made from the extreme variation in contrast of the four negatives.



22. SCENE BRIGHTNESS RANGE.

able to make use of the full useful range of tone values of which the paper is capable, from a very faint gray to a strong black. While there is only one time of development for the negative that will give the optimum negative density range for use with any grade of paper, there are, fortunately, several different grades of paper available in most surfaces. A cursory survey of positive papers will tell us what may be considered as a normal negative. Because of the fact that the negative density range can be controlled over wide limits by the length of time of development, a given scene can give rise to an indefinite number of negatives with different density ranges simply by controlling the length of development time. Some of these negatives, of course, will print on normal paper, some on soft paper, and some on contrast paper. A few experiments will indicate the type of negative that prints best on the various grades of paper.

Slight differences may be noted between a diffusion and condenser enlarger but the same theory applies to both cases. Figure 20 shows that negatives with a density range from 0.75 to 1.05 will fit medium or normal paper of this particular manufacture very satisfactorily while the soft and contrast papers will have their own particular bands.

Now that the requirements of the paper are known and the method of control is known, it should be a relatively simple matter for the photographer to plan his development for a given scene to fit any of the four grades of paper that might be desirable. To take a practical case, Figure 21 may be considered.

By taking a reading of the brightest and darkest areas in this scene it is possible to determine that the same brightness range was 1 to 32. In other words, the reading taken in the shadows was a value of 10, while the reading taken on the sky was a value of 320. These four negatives on the left hand side of this picture were developed each for a different length of time and are such that they fit the four different grades of paper and produce prints that use the full tone range of the paper.

If the characteristic curve of the negative material on which this scene was taken were plotted for the four different negatives shown in the Figure 21, it would look something like Figure 22.

It will be noted that while the same exposure was given to each one of the four scenes, one of them was developed to a gamma of approximately 0.4, the next one approximately 0.5, and so on up to 0.9. The resulting negative density ranges were 0.60, 0.75, 1.05 and 1.35.

It is then possible to prepare a table summarizing this information not only for these few cases, but for a number of scene brightness ranges. This should be sufficient at least to act as a guide for the vast majority of conditions. (See Figure 23)

Examining this chart one finds that it covers the scenes having a range of brightness from 4 to approximately 256 and then shows the gamma or contrast of development on the left hand side that would produce a wide variety of negative density ranges. In the upper left hand corner of the squares that have been outlined with a heavy black line appears a small number that is indicative of the grade of paper required to make the print. In other words, starting down the column for a scene having a brightness range of 16, one finds that a gamma of 0.7 would produce a negative having a density range of 0.84 and that this could be printed on a No. 3 paper. So on for the other gammas of development.

It may be recalled that in an earlier discussion of development in this chapter a suggestion was made that the development be held within the limits of gamma 0.7 and 0.8. The reason for this is, of course, readily apparent in that those two gammas enable the average scene to be printed on the average grades of paper. In other words, if the photographer had taken a roll of pictures and found that the preponderance of his scenes had a brightness range of 32, he would know that this scene would print on a normal paper to be developed to a gamma of 0.7 and that the more contrasty scenes would print on a soft paper and so on.

Figure 24 shows a typical time-gamma table for a number of different films in two different developers.

GAMMA OF DEVELOPMENT	SCENE BRIGHTNESS RANGE 4	8	16	32	64	128	256
0.4	0.24	0.36	0.48	4 / 0.60	3 / 0.72	3 / 0.84	2 / 0.96
0.5	0.30	0.45	4 / 0.60	3 / 0.75	2 / 0.90	2 / 1.05	1 / 1.20
0.6	0.36	0.54	3 / 0.72	2 / 0.90	2 / 1.08	1 / 1.26	1.44
0.7	0.42	4 / 0.63	3 / 0.84	2 / 1.05	1 / 1.26	1.47	1.68
0.8	0.48	3 / 0.72	2 / 0.96	1 / 1.20	1.44	1.68	1.92
0.9	0.54	3 / 0.81	2 / 1.08	1 / 1.35	1.62	1.89	2.16
1.0	4 / 0.60	2 / 0.90	1 / 1.20	1.50	1.80	2.10	2.40
1.1	4 / 0.66	2 / 0.99	1 / 1.32	1.65	1.98	2.31	2.64
1.2	3 / 0.72	2 / 1.08	1.44	1.80	2.16	2.52	2.88
1.3	3 / 0.78	1 / 1.17	1.56	1.95	2.34	2.73	3.12

23. NEGATIVE DENSITY RANGE.

Time Gamma Table for D1 Developer: Develop at 70°

Gamma	.5		.7		.9		1.0		1.2		1.5	
	M	S	M	S	M	S	M	S	M	S	M	S
X-F Ortho	3	30	5	15	8	00	9	30				
Portrait	4	00	6	00	9	30	13					
Portrait HGS	3	45	5	30	8	30	10	30				
Pentagon	4	30	6	45	9	45	12		17	30		
X-F Pan	2	00	3	30	5	00	5	45	7	40		
Fine Grain Pan			2	00	2	30	3	00	3	45	6	00
Commercial			3	45	5	45	6	30	9	00		

Time Gamma Table for D6 Developer: Develop at 70°

Gamma	.5		.7		.9		1.0		1.2		1.5	
	M	S	M	S	M	S	M	S	M	S	M	S
X-F Ortho	4	15	7	30	15	00	22	00				
Portrait	5	30	10	00	20	00						
Portrait HGS	4	30	8	00	16	00	24	00				
Pentagon	5	30	8	00	12	00	18	00				
X-F Pan	5	45	8	30	13	00	16	00	25	00		
Fine Grain Pan	2	00	3	00	4	30	5	30	8	00	12	30
Commercial	2	30	4	00	6	00	7	00	10	00		

24. A TIME-GAMMA TABLE.

This particular table is standard with one of the film manufacturers and will be found inserted in all packages of cut film.

Now to sum up the system, suppose a typical case is illustrated. By closeup exposure meter measurements the scene brightness range is determined to have a ratio of 1:64. The exposure or camera settings are then determined by being sure that the brightest and darkest objects fall within the "U" and the "O" position. The negative is now ready to be developed, and by referring to the table in Figure 23 it will be found that to print on a No. 2 paper it is necessary that this particular negative be developed to a gamma of 0.5 or 0.6. Assuming that a portrait film and developer D-6 at 70° F. is used, Figure 24 shows that 5½ minutes will produce a gamma of 0.5. All things being equal this negative could be expected to print on a normal paper.

In the process of making a photographic print there are about twenty possible variables that enter into the making of a print from the time the scene is selected until the print is dry. These values should be considered as a guide rather than an absolute rule. The desirable part is that even if the individual conditions governing one man's work are somewhat different from standard, he will still find that his results are far closer than he could hope to guess. Furthermore, if he keeps his processing standardized he should expect to be able to reproduce his results very well, certainly far better than he could by guessing.

Controlling the Scene Lighting

Having found a method of fitting the scene to the paper it will frequently be desirable to control the brightness range of the scene in order to soften the results that would otherwise be too harsh.

The professional motion picture industry uses the universal type exposure meter frequently in arranging the lighting on both indoor and outdoor scenes in such a way that the brightness range is as nearly constant as is possible. In other words, they frequently build up the shadows with spotlights or diffuse the lights falling on the highlights until the entire scene is within a certain predetermined range. Because of this controlled lighting the resulting positives that are viewed in the theatre are much more uniform and therefore much more pleasing to watch.

It is equally true in regular photography that controlled lighting will yield more uniform results. Whether these results be soft or contrasty is purely a matter of personal choice, but the fact that the universal exposure meter will give the photographer the ability to control these results is the important consideration.

Figures 25, 26 and 27 show three different effects achieved by simply changing the lighting of what might be otherwise a troublesome portrait.

In terms of the scene brightness range we find that the brightest part of the boy's shirt gives a closeup reading of 200, while the shadow side of the face reads 5. This represents a brightness range of 1 to 40, which is within the film latitude and just about equal to the paper tone range. However, in making a straight print from Figure 25 the contrast is a little too strong. Of course, if it were printed on a softer paper more detail would go in both the highlights and the shadows. However, from the standpoint of print quality the picture would be degraded for it would no longer show the maximum black

25. Strong sunlight from one source makes this picture too contrasty for good reproduction.

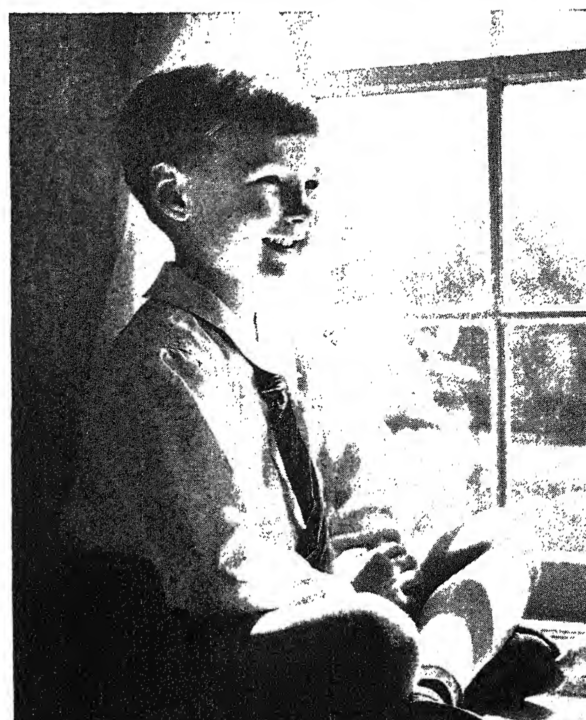
and purest white of which the paper is capable. Hence. in order to keep the quality of the print and still include all of the detail that should show in both highlights and shadows, the lighting should be modified somewhat.

This has been done in Figure 26 by placing a simple reflector on the shadow side of the picture in such a way that the shadows become brighter. Of course the highlight reading remains the same (200) with the shadow reading increasing from 5 to 10. In this way the scene brightness range has been reduced from 1 to 40 to 1 to 20.

The same procedure can be carried further until the reading in the shadows has been increased to any desired value. In the case of Figure 27 the reflector was adjusted until the shadow reading was increased to a value of 20. When this was done the scene range was reduced to 1 to 10, and the result is even softer than before. However, in spite of this reduction in scene brightness range it can still be printed on a grade of paper hard enough to permit good solid black and clear white.

It makes no difference which of the three pictures appeals to you most; the point to remember is that by means of the universal exposure meter it is possible for one to reproduce pictures in the same general manner by measuring the brightness range and adjusting it until it falls within given limits, say 1 to 20 or any other value you may select. This particular method is essential in color photography where the range of brightness values that can be handled is limited to a considerably greater extent than black and white.

26. A reflector improves the lighting.



27. With proper adjustment the reflector illuminates the shadows to make a good photograph.

Special Photographic Effects

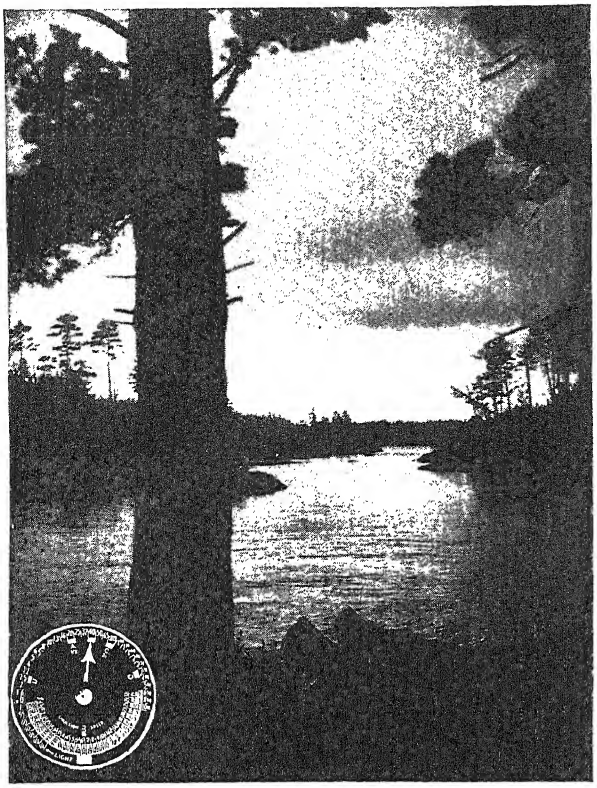
There are many photographic effects which greatly enhance certain types of scenes. Some of them are ordinarily rather difficult to produce. However, an exposure meter simplifies some of this work quite materially.

SILHOUETTE. The silhouette such as shown in Figure 28 can be taken quite easily by simply measuring the object to be silhouetted.

Then, instead of exposing normally, the "U" position is placed opposite the reading obtained. In the present case the tree trunks gave a reading of 2.5 opposite which the "U" position on the exposure guide dial of the universal type meter was placed. By so doing the very minimum exposure is given to the tree and any darker objects. In printing the negative with full black the detail in the shadows is purposely lost as shown.

NIGHT SCENES. Night scenes can be produced in daylight the same way except that a heavy yellow or red filter should be used to darken the sky and thereby give the appearance of night.

HIGH AND LOW KEY PRINTS. In making pictures of this type it should be remembered that we simply use the highlight and brighter half tones for high key, and shadows and darker half tones for low key work.



28. A SILHOUETTE. See page 35 for complete explanation.

In high key work the lighting is balanced very evenly so that there are very few shadows in the subject. The brightest highlight and darkest half tone in the scene should be measured. Then the normal arrow on the universal meter should be placed opposite the reading obtained on the darkest half tone. In so doing the negative will be well exposed which will make it easy to keep from printing any heavy shadows. To have the print most flattering care should be exercised that it is not printed too dark.

Obtaining the Maximum Film Speed

The emulsion speed value for use with an exposure meter should be arranged in such a way that the film will be useful regardless of the brightness range of the scene within the film latitude.

It can readily be seen that in order to achieve this end it is necessary to base a practical emulsion speed value system on a definite point of the film's characteristic curve. Such a method was devised in the Weston system and since it has come into rather wide use in the United States and abroad, it is therefore being discussed in this section.

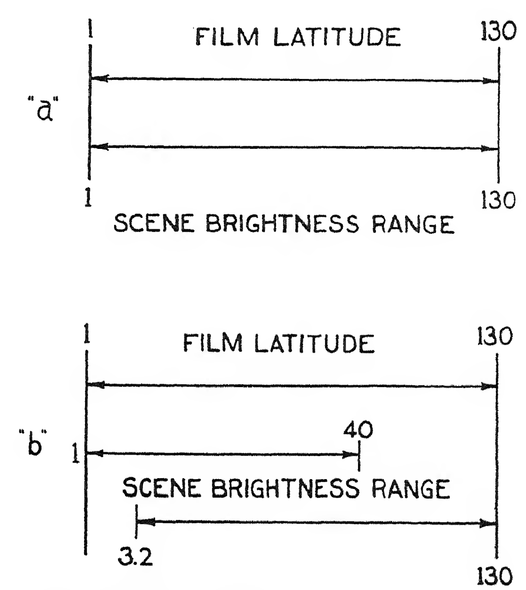
The particular advantage of this system is that it is largely independent of the shape of the characteristic curve and gives the photographer the greatest latitude of error on either side of the central or starting point. It is, however, definitely related to the film latitude and the scene brightness range. To indicate this relation one may refer to Figure 29.

Since it is fair to assume that the useful latitude of the average film is 1 to 130, it can easily be seen from Figure 29a that when the scene brightness range equals the film latitude, the exposure must be exact. In other words, any increase in exposure would cause a tendency to over expose the highlights while any decrease in exposure would make separation in the shadows quite difficult. Hence, in the case of a scene of this type an accurate emulsion speed is quite important.

If, however, the scene brightness range is less than the film latitude, then the emulsion speed setting on the meter can be varied and while the overall density will be increased or decreased the change can take place anywhere within the film latitude without causing the quality of the print to be impaired. Figure 29b represents the case of a scene having a brightness range of 1 to 40. This means that the emulsion speed value setting can be varied by a factor of 3 and still produce a very good rendition of the original scene. It is undoubtedly for this reason that the old adage of photography came into being—"expose the shadows and develop for the highlights." For frequently the scene brightness range is much less than the film latitude, so that increasing the exposure two or three times will not over expose the highlights, provided of course *we do not over develop.*

To carry this into practice we can see from Figure 30 the effect of such film speed variation.

The brightness range of the particular scene in question was measured as 1 to 40, and a correct film speed was used in exposing the center negative. The same scene was then exposed at one-half the normal emulsion speed value and twice the normal emulsion speed value. The right and left negatives resulted. The actual prints, of course, look very similar because it was arranged to keep the brightness limits within the latitude of the film.



29. FILM SPEED VARIATION.

Incidentally, all three negatives were developed simultaneously and because the density difference (between maximum and minimum negative density) was the same on all three negatives, all were printed on the same grade of positive paper.

The conclusion to be drawn from this is very significant. *We should not try to check a film speed for our own camera equipment, unless we measure the brightness range of the scene used for the test.*

Suppose in this case we had used the left hand negative for the test without taking the other two. Checking back from the exposure data we would say that double the Weston speed value could be used. While this is true for a scene where the range of brightness is 1 to 40, it would most certainly not be true for a scene where the brightness range is equal to or greater than the film latitude. Figure 18 proves this quite conclusively for it can be seen that the shadows would suffer and the print would lose brilliance if a higher than rated Weston speed value were used on such a wide range scene.

However, there is another way of obtaining the full useful emulsion speed value that is particularly useful when scenes of short brightness range are encountered. This is called the darkest object method of exposure and will yield the thinnest correct negative possible. In some cases there are actually advantages to this method. It keeps the enlarging time at a minimum because of the fact that the densities are at a minimum, and the light is not impeded as much as with heavier negatives.

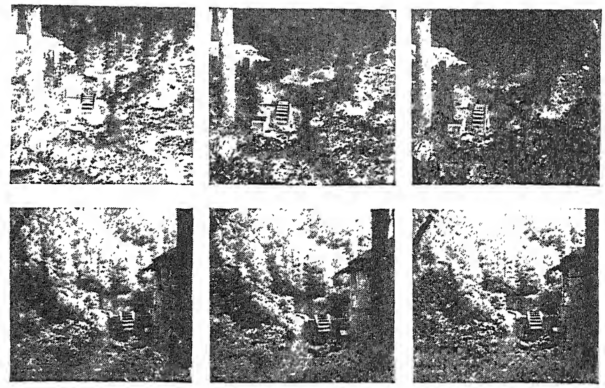
It keeps the graininess small because, of course, the thinner the densities are the less the appearance of grain is noticed.

It permits a higher shutter speed which often prevents camera motion from causing slight blur to the picture, and by the same token permits greater depth of field since a smaller aperture can be used.

It should be clearly understood that in suggesting the minimum exposure this does not mean under exposure, but simply means utilizing the lower end of the film characteristics.

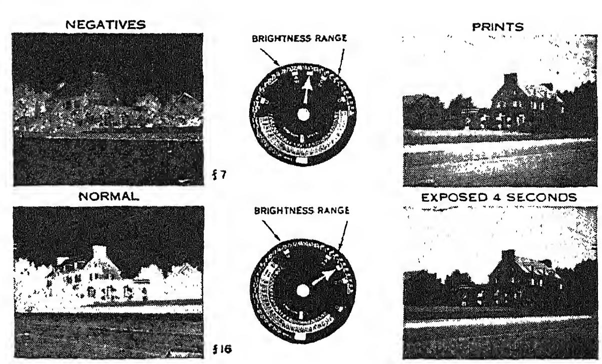
This is achieved by taking a closeup meter reading on the darkest object in the scene in which detail is wanted, and placing the "U" position on the exposure guide dial opposite that reading. In this way the darkest object measured will have a density of approximately 0.1 on the negative and everything brighter in the scene will have the correspondingly greater density. Of course it is not always convenient to take a closeup reading in the shadow area of a scene, nor is it always necessary. It has been shown previously that excellent results can be obtained by camera position readings of the general scene, but if any particular scene is important enough for you to want the sharpest results and highest emulsion speed value, then the closeup reading will surely seem desirable.

Figure 31 shows the application of the procedure just explained. The brightness range of the scene is designated by the arrows as 20 and 200, the closeup readings being made on the foliage and the bright sidewalk. From these readings it is possible to make either a normal or a thin negative as shown in the Figure, simply by setting the exposure guide dial on the universal exposure meter. For a normal negative, the normal arrow is balanced half-way between the two readings marked by the arrows, but for the thin negative the "U" position is placed opposite the reading obtained on the dark foliage. In doing so we expose in such a way that the light reflected from the foliage produces a minimum necessary density on the film of about 0.1. It should be noted that a very good print can be produced from both negatives although the printing time is much less for the thin negative.



30. FILM SPEED VARIATION.

It will be noted that whereas the film had a latitude of 1 to 130, in this case the scene has a brightness range considerably less, and whenever this is the case the effective emulsion speed value is increased by the darkest object method. In other words, whereas the normal negative was made at f:7, the thin negative was made at f:16. Translating this into emulsion speed value, it is an increase of over three times the normal value. The desirable feature of this method, however, lies in the fact that the photographer is continually protected against the eventuality of the occasional scene whose brightness range is the full latitude of the film. In other words, had the



31. CONTROL OF NEGATIVE DENSITY.

photographer arbitrarily increased the emulsion speed value setting to take the short range scenes properly he would be disappointed when a longer range scene was encountered by the fact that shadow detail would be lacking. Of course, if all scenes had the same range of brightness it would be very easy to set the camera but such is not the case and it is the reason why the exposure meter is particularly desirable for this work.

Exposing Color Transparencies

There are a number of processes available for making full color transparent pictures. These may be viewed by holding the picture up to a light or projecting it on a screen. The following are a few of the processes for producing such transparencies: Agfa Color, Dufaycolor, Finley, Lumiere and Kodachrome.

The advantage of using transparencies is that they make a picture that can be viewed in several ways:

1. By transmission.
2. By reflection from a screen.
3. By making a black-and-white print from them.*
4. By making a color print from them.*

Hence if properly prepared initially they can be extremely useful as an almost universal medium. While it is quite true that if properly taken the results will be most pleasing, a greater degree of care and precision must be employed than in black-and-white photography. To illustrate a few of these important points and the proper methods of exposure, one system is being selected. Similar reasoning may be used for the other processes. In the case of Kodachrome film the photographer has a medium that can be loaded in the regular manner into the camera and exposed in the usual way. After exposure the film is returned to the manufacturer for processing.

Since the film is processed by the manufacturer the photographer's important consideration with Kodachrome film is *to expose his film accurately to the type of illumination for which the film has been balanced.*

Within reasonable limits it is possible to manufacture a color film which would be balanced for any one of a number of different light sources. For instance, a film could be made to be correct in daylight which is quite blue, or in sunlight which is more yellow, and so on. But the best results will obviously be obtained when the film is exposed in the light for which it was balanced.

Lighting. An approximate idea of the relation between the various colors for different illumination normally used in photography is shown in Figure 32. Here it will be seen that there is a greater percentage of blue in daylight than any other ordinary illumination. Also there is more red in Mazda than the others listed.

*See Exposure Makes the Print, H. P. Rockwell, Jr., Journal Photographic Society of America, July, 1939, Section 6.

RELATIVE SPECTRAL OUTPUT (PERCENT)

LIGHT SOURCE	VIOLET	BLUE	GREEN	YELLOW ORANGE	RED
MILLIMICRONS—	400-450	450-475	475-580	580-620	620-700
MAZDA (100 W. LAMP)	21	36	78	125	175
PROJECTION (300 W. LAMP)	32	48	80	122	151
PHOTOFLOOD (250 W. LAMP)	39	55	85	115	133
WONDERLITE FILTER FLOOD 330 W. LAMP	60	70	85	90	90
EQUIV. SUNLITE	68	76	79	76	68
EQUIV. DAYLITE	80	84	76	55	48

32. COLOR DISTRIBUTION OF COMMON LIGHTS.

Curiously enough these differences are not readily apparent to our eye. The human eye becomes accustomed to these changes and they are noticeable only when a conscious effort is made to find them. When the photographer does this he will find that out of doors on a cloudy overcast day he will notice that there is a blue cast over everything which when photographed will give the scene a rather cold dreary appearance. Hence, when the picture is viewed by Mazda (in which it is intended to be viewed) the photographer will see the bluish color and become very conscious of the fact that the picture appears cold. On the other hand, the same picture in sunlight would look much warmer and more natural if properly exposed.

Film and Filters. To forestall any mistake it is well to be acquainted with the proper film to be used on the proper conditions and the proper filter to be used when conditions are somewhat different from normal. Figure 33 shows the light sources for which the various types of Kodachrome are balanced, and the proper filters required for alternate light sources.

Suppose the photographer had Type B Kodachrome and wanted to use it in sunlight. It would be necessary to photograph through a Wratten No. 85B filter in order that the scene look satisfactory. For distance

KODACHROME FILTER CHART

KODACHROME	BALANCED FOR	IN SUNLIGHT	IN ARTIFICIAL LIGHT
REGULAR 8-16 and 35 MILLIMETER	SUNLIGHT	NO FILTER	PHOTOFLOOD FILTER WRATTEN #80
TYPE A 8-16 and 35 MILLIMETER	PHOTOFLOOD (3400°K)	SUN LIGHT FILTER WRATTEN #85	NO FILTER
PROFESSIONAL CUT FILM	SUNLIGHT	NO FILTER	
TYPE B CUT FILM	HIGH EFFICIENCY TUNGSTEN (3200°K)	WRATTEN #85B	WRATTEN #2A

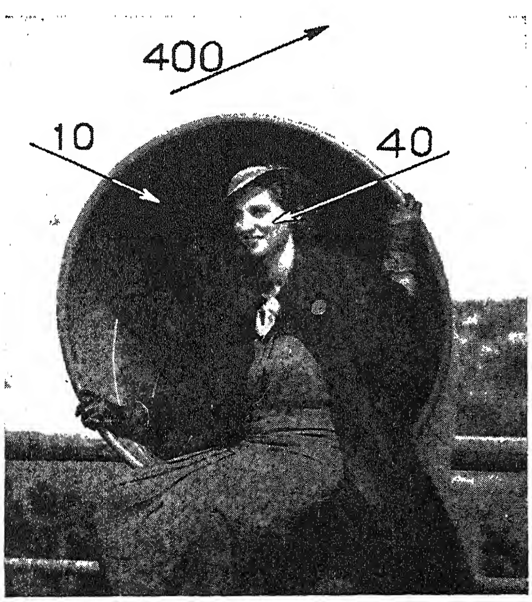
33. KODACHROME FILTER CHART.

shots taken out of doors the haze filter should be added and here no change in exposure is required. It should be noted that the emulsion speed value for Kodachrome is quite important and should be determined from the exposure meter manufacturer.

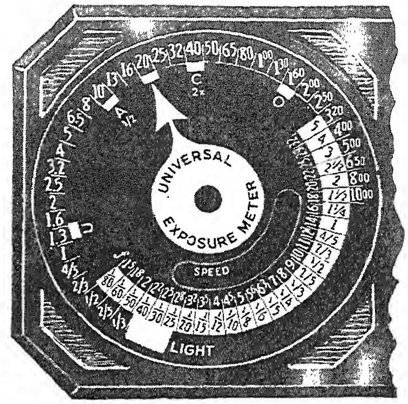
Scene Brightness Range. Probably the most important consideration in correctly exposing any of these color transparency films is the brightness range of the scene being photographed. It should be remembered that there are three layers of emulsion, each sensitive to its own particular color and that they lie one on top of the other. This means that even if each layer of emulsion is developed to a relatively low gamma, the final gamma may be higher than normal and hence the latitude will of necessity be reduced with respect to a black-and-white film. This, of course, is an advantage in projection because the screen can handle a greater range of brightness values than the photographic print. Also in making the print from a transparency the photographer is able to control his developments and reduce the contrast to suit the printing medium.

It is probably for this reason that so many of the directions for making color transparencies suggest flat or even lighting rather than the more dramatic types of lighting used in black and white because, of course, the colors produce their own contrast rather than depending upon the highlights and shadows in the scene.

If the range of brightness values in the scene is particularly small, and can be recognized as that of flat lighting immediately, then only one exposure meter reading is necessary; but on the contrary if there is any question that the scene may have a wide range it is worth while to take a reading of the brightest and darkest *color* in which good color rendition is desired.



34. VARIATIONS IN REFLECTED LIGHT.



35. BALANCE THE READINGS FOR COLOR WORK.

The photographer will then know the actual range of brightness values in his scene and will know whether or not they will produce a pleasing result. Probably one of the sources of difficulty in making color transparencies lies in the fact that the photographer may have failed to recognize that a given scene had a relatively wide range of brightness and therefore could not be expected to produce satisfactory results. Furthermore, there are a number of occasions where it becomes possible by slightly moving the position of the camera, or taking the picture from a different angle, to reduce the range of brightness in the scene without losing the important part. If, therefore, the color worker recognizes the importance of knowing the scene brightness range he certainly won't mind taking two readings instead of one.

Exposure. In determining the correct camera setting for a great majority of scenes the photographer should observe the parts of the scene in which he is interested and then take his measurements close to the brightest color and the darkest color, and then *balance the normal arrow half-way in between the two readings so obtained.*

Suppose the photographer encounters a scene such as Figure 34 where the brightest color is 40 and the darkest color is 10.

It should be noted in this case that the sky being almost white was not a color, and although it is much brighter than the rest of the scene it should not be considered in making the exposure setting. Figure 35 shows the correct exposure guide dial setting for such a scene.

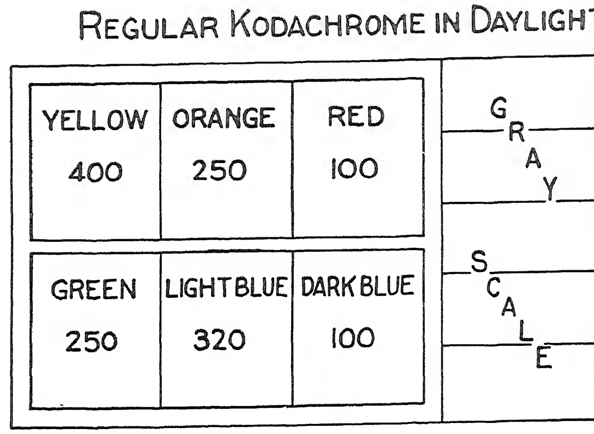
It will be seen that since 10 and 40 represented the brightest and darkest colors in which detail was required, that the normal arrow was placed halfway between the color limits. If, however, the scene had given a reading of 5 and 80 for the brightest and darkest colors, respectively, it would be necessary to decide which of the colors the photographer wanted to favor, because it would be quite difficult to hold detail in the extreme ends of a scene with as wide a range as this.

Latitude is an extremely elusive quantity in the color field, and is rather hard to define. However, a great many tests indicate that for best rendition an effort should be made to keep the important parts of the scene *within the "A" and the "C" positions on the meter.* In the present example it will be seen that since the darkest color which gave a reading of 5 lies outside the "A" position it may lack detail and since the brighter colors lie outside of the "C" position they may be somewhat too light. Hence if it were possible to reduce the range of brightness of this scene slightly it would be very helpful.

Substitution. If the scene is such that the important objects are inaccessible such as scenes from a roof or a boat, it is desirable to take readings from objects near at hand and approximate the colors of the principal objects in the scene. For example, in photographing a fountain from a high roof it would, of course, have been inconvenient to have to go down to the fountain to take a closeup reading and then come back up to the roof to make the picture. Fortunately, however, the sky was the brightest color in the scene and that could be readily measured from the roof, and some nearby terra cotta was very similar to the dark stone work of the fountain. The normal arrow was balanced between these two readings and the resulting picture was excellent. At the same time a picture was made by using the one average reading taken by sighting directly at the scene, but because of the fact that there was a large sky area and a large amount of water in the scene, the reading was inflated by these bright areas and the picture was considerably too dark.

Inaccessible Subjects. There are, however, times when even the substitution method is rather difficult to apply such as for example trying to photograph an airplane landing at an airport. In a case of this kind the only color which is usually available is the blue of the sky and if the exposure can be arranged to make the sky appear its normal blue, then at least the objects which are reasonably close to the sky in brightness will be correctly exposed. There are two ways in which this may be done. First, recognizing the fact that good results can usually be expected by limiting the brightness values of the scene to within the "A" and "C" positions on the exposure guide dial, and since the sky is usually the brightest color the "C" position should be set on the sky reading and the picture will undoubtedly be quite satisfactory.

If, however, the airplane is the darkest object in the scene, a more dramatic effect can be obtained by purposely under exposing the sky slightly to make it appear more blue than normal. This can be done by setting the normal arrow opposite the sky reading instead of the "C" position. This same technique can sometimes be employed successfully on short range scenes where time does not permit the brightness range method of exposure as described above to be employed.



36. COLOR TEST CHART.

Sunsets. Sunsets frequently produce very beautiful color transparencies and they are really quite simple to photograph in a pleasing manner. The normal film speed should be employed and a reading should be taken directly at the sun and another with the instrument pointed up to the zenith. In other words, do not take readings on closeup dark objects, but let these be under exposed to silhouette the scene. Then set the normal arrow half-way in between the two brightness values thus obtained.

Snow Scenes. Camera position readings should be avoided particularly when taking pictures of snow or scenes at the beach because since snow and the sand are crystalline in substance they frequently reflect direct sunlight into the exposure meter and cause an inflated reading. However, by going close to the brightest and darkest colors in the scene, the correct exposure will be obtained for the principal objects, and then the slight reflections that may be obtained from the small crystalline facets of the sand and the snow will add to the brilliance of the final picture. If the photographer is interested in showing the texture of the sand or the snow this method is particularly helpful.

Projection Data. In order to obtain the best color from projected transparencies care should be taken that the lamp used in the projector is as near as possible to the voltage of the line in your particular community. The screen should be such that it does not suppress or emphasize any particular color but reflect all alike. It will then show the same colors that were projected by the lamp. It is well to take a brightness reading from the screen with your exposure meter and if the projection is of such a size that the brightness value is 5 candles per square foot, or greater, a Matte surface screen should be employed. If, however, the brightness is lower than 5 candles per square foot a Beaded screen will be helpful in brightening up the projected trans-

WESTON SPEED VALUE KODACHROME

COLOR	BRIGHTNESS	BEST FRAME	EXPOSURE	SPEED
RED	100	37	1/30 Sec. f:6.3	10
ORANGE	250	40	1/30 Sec. f:9	8
YELLOW	400	36	1/30 Sec. f:5.6	2.5
GREEN	250	40	1/30 Sec. f:9	8
BLUE	320	44	1/30 Sec. f:14	16
OVERALL	100	35	1/30 Sec. f:5	6

37. DETERMINING WESTON SPEED VALUES FOR KODACHROME.

parencies for those observers sitting near the center line of the screen.

COLOR TEMPERATURE. For those interested in controlling the color output of their light sources in taking the color transparencies, or projecting them, a knowledge of the subject of color temperature and its measurements will be very helpful. Any standard work on optics will usually give references to this subject and instruments are available for measuring the color temperature of a light source. The following is a tabulation of a few of the more commonly encountered color temperature values.

Clear blue sky (north)	—12,000° Kelvin and up
Clear blue sky with sunlight	— 6,500° Kelvin
Average noon sunlight	— 5,400° Kelvin
250-Watt Photoflood lamp	— 3,400° Kelvin
500-Watt Projection lamp	— 3,200° Kelvin
500-Watt Gas-filled Tungsten lamp	— 2,900° Kelvin
100-Watt Gas-filled Tungsten lamp	— 2,800° Kelvin
50-Watt Tungsten lamp	— 2,500° Kelvin

EMULSION SPEED VALUES FOR VARIOUS COLORS. Some workers feel that since an exposure meter does not see colors exactly as the film does, it may not be useful in color work. This is *far from the case.* As a matter of fact even if the photoelectric cell did see the various colors exactly as one particular film would see them, it would certainly not see the colors the same as the film would in another type of light source. For example—Daylight and Tungsten are entirely different and yet a meter can and is used successfully in both.

It is not a serious consideration for the majority of cases, but if it is necessary to do a particularly specialized type of photography then the photographer can determine the speed for each color which will be best suited for his camera, lens, lights, and exposure meter. In this way he will have settled the problem for his own conditions.

It is well to procure a few feet of show card stock of each color desired, and cut them to about 10" square. They should be affixed to a support with a gray scale if possible. Figure 36 shows a typical arrangement of this kind.

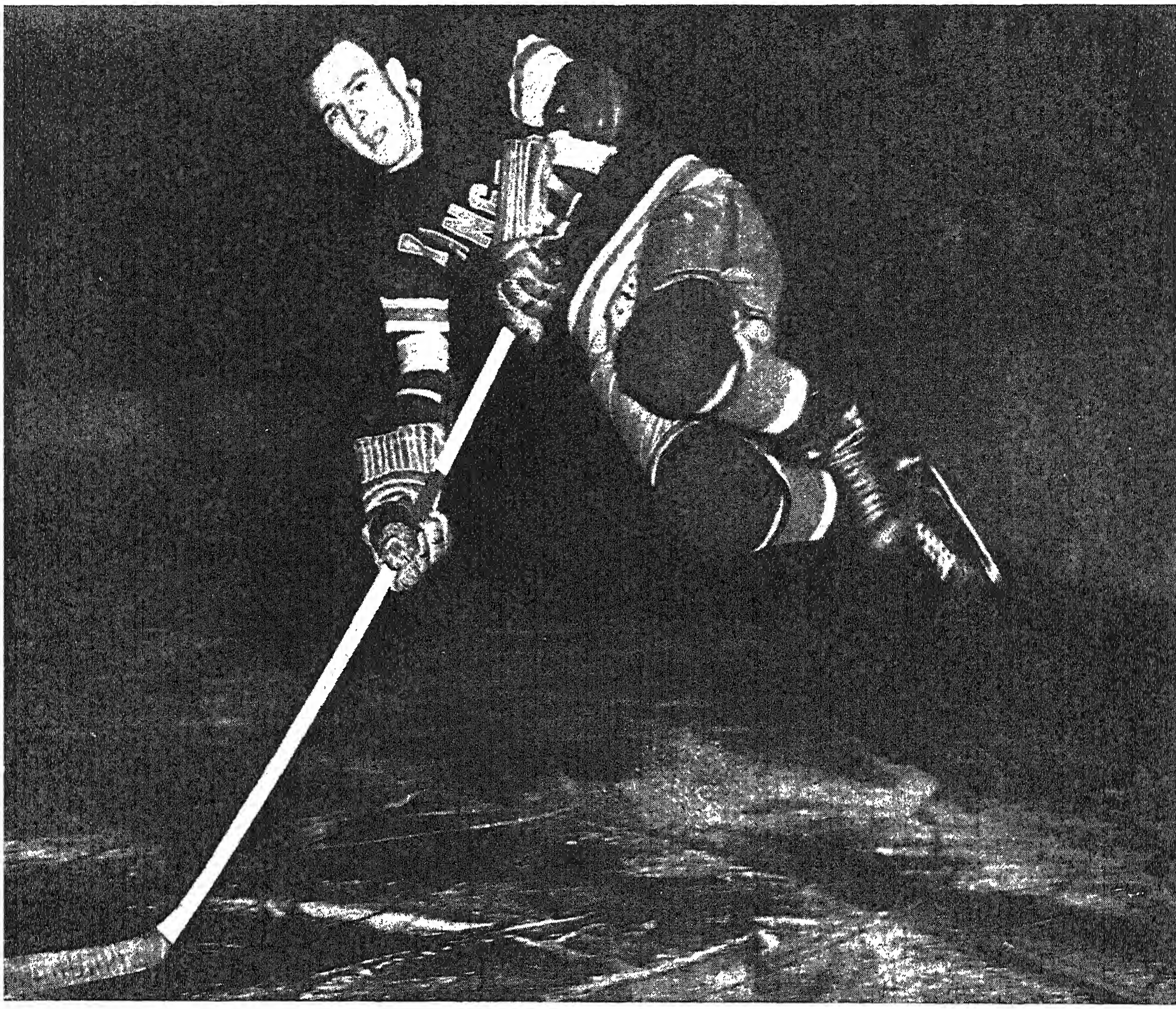
Now assume that there is no such thing as an exposure meter and make a half-dozen exposures of the color chart, varying the exposure on both sides of the starting point by one-half stop.

It is suggested for the purpose of this test that all exposures be made at the same shutter speed and that the lens aperture be varied rather than the shutter. Also it is well to always move the lens diaphragm in one direction to eliminate any possible backlash. If for instance you have decided to always stop your lens *down*, then follow this procedure regularly. If your lens is set for f:11 and you wish to use f:8, open the lens fully and then close *down* to f:8. This will increase the accuracy of the test materially.

When the films are processed it is possible to compare them with the original. They should be projected and notes should be made on the negative that shows the best comparison with the original for each color. Remember that while the human eye cannot measure, with any degree of accuracy, it can compare colors very well. This process should be continued for each color photographed. When completed it may be noted that different exposures are best for different colors. This is not a drawback because as long as it is recognized the information can be used very easily.

Up to this point the exposure meter has not been considered, but now if the camera setting for each of the best frames for the individual colors be recorded, together with the brightness value of that color, it is possible to determine the optimum speed value for that color as shown in Figure 37.

Now if the scene predominates in green you need not worry about any color sensitivity problem; you will have already determined this effect. You need only set the meter for the green speed and use the normal arrow opposite the important green reading and be sure that this will be correctly exposed.



THE MAN ON THE FLYING HOCKEY STICK. Fast synchroflash action made by William Greene, *New York World-Telegram.* 4 x 5 Speed Graphic, 6-inch Hugo Meyer lens, 1/200 second, f:8, Fast Pan film, photographed indoors at Madison Square Garden using one flashbulb. From *U. S. Camera* magazine.

HOW TO CHOOSE A LENS

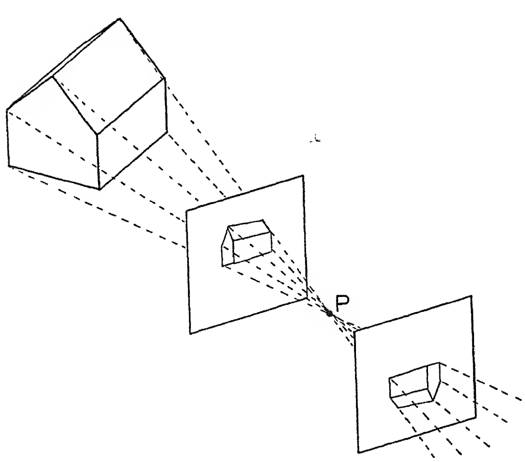
R. KINGSLAKE

When a camera is equipped to accept a wide range of interchangeable lenses differing in focal length, aperture, and make, it is often a great problem to decide which lens to use for a given purpose, or which lens to purchase with a new camera. A little knowledge of photographic optics, and an appreciation of the fundamentals of perspective, may be of considerable help in answering these awkward questions, and every serious camera user should make himself thoroughly familiar with these matters.

A lens is defined by two linear dimensions, its focal length and its diameter or aperture, while the manner in which the lens is used is further determined by the size of the plate or film and the distance of the object. These factors control the perspective, the speed of the lens, the depth of field, and the angular field of view. In addition, a lens must give adequate sharpness of definition over the whole picture, and a true representation of the contrast between adjacent light and dark regions. These topics will be discussed in order, beginning with the most important, namely perspective, for no photograph will be pleasing unless it "looks right."

Perspective

When we look at an assemblage of objects, some near and some far, some small and some large, we receive a mental picture which we could plot out point-by-point on a plate of glass erected between the objects and our eye (Fig. 1). In this diagram, the eye is supposed to be at P, and the appearance of the house as seen by this observer is shown traced on the sheet of glass. The only difference between this glass-plate picture and the picture formed by our camera is that in the camera the rays cross each other at the camera lens at P in Figure 1, and are intercepted by a plate or film placed behind the lens. The inverted picture projected on the film will be identical with that traced on the glass plate provided both are at the same distance from P. The point P is then called the "Center of Perspective."

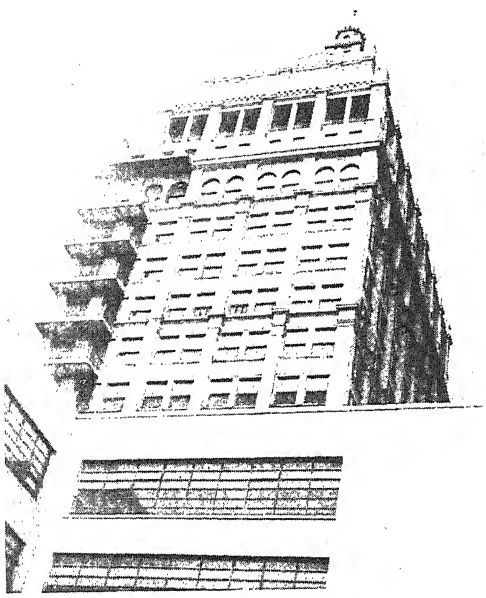


1. Illustrating the meaning of "Center of Perspective."

It is a convention of great antiquity that the two-dimensional plane on which we project our picture of a three-dimensional object shall be vertical. The appearance will then be that seen when we hold our head upright and look horizontally forward. If we look upward at a high building, we shall see the sides apparently converging to a point in the sky, and a photograph (Fig. 2) made on an inclined plate shows this same effect faithfully reproduced. But for some reason, this appearance looks unreal in a photograph, and is to be avoided except where it is desired to suggest great height deliberately.

The second rule which must be observed to secure good perspective is that the entire object being photographed should be as far as possible from the camera. Failure to observe this may result in an absurdly exaggerated magnification (Fig. 3) of those parts of the object which are nearest to the camera. This is because the camera lacks the intelligent interpretation of our surroundings which our brain is continually and unconsciously making.

The third point to be remembered in picture making is that the eye cannot take in satisfactorily at a glance an angular field much greater than, perhaps, 30 degrees. However, when examining a stationary picture we are free to scan it by rolling our eyes, and a 50 degree field then appears quite satisfactory. This is about the angle subtended by an object which is as wide as its distance from the eye, and for a great many years it has, therefore, been the custom to equip cameras with lenses having a focal length about equal to the diagonal of the film covered.



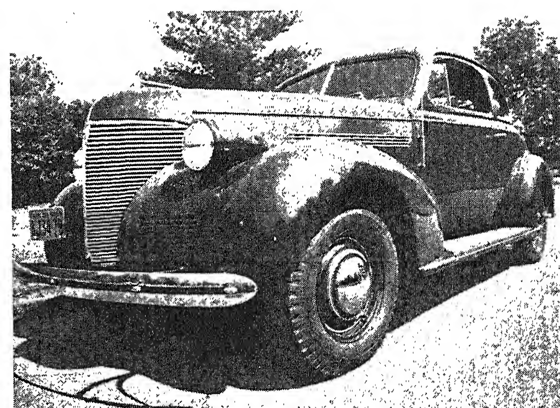
2. Illustrating the result of tilting the camera front upward and backward. Note lines converging at top.

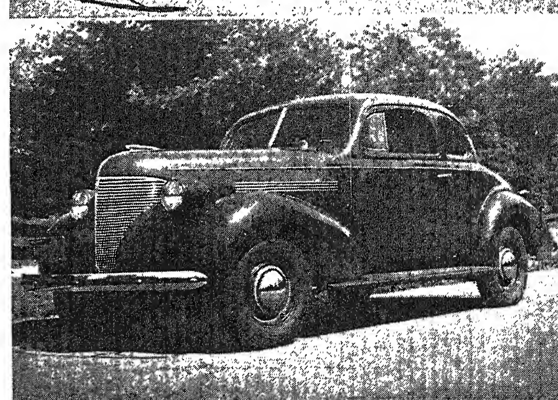
The fourth and most important condition for correct perspective is that the final picture must be looked at from the correct center of perspective, which in contact prints is at the point originally occupied by the lens of the camera. Only so will all the relative angular dimensions of the various objects in the field of view be correctly reproduced to the eye. This explains the familiar enormous improvement in the "naturalness" of a small snapshot when it is looked at through a magnifying glass having a focal length about equal to the focal length of the camera lens. Similarly, if a picture taken with a 4-inch lens is enlarged three times, the center of perspective will be moved away to a point 12 inches from the print, and as this is about the normal viewing distance, an enlargement always appears much more realistic and satisfying than the original contact print. In the case of pictures projected on to a screen, the correct viewing distance is equal to the distance from the projector to the screen multiplied by the ratio of the focal length of the camera lens to that of the projection lens. These "correct" viewing distances are not critical, but a departure from the correct distance by more than a factor of 2 is serious insofar as a realistic reproduction of the perspective is concerned.

Photographs taken with even a very wide angle lens appear natural to the eye if they are viewed from the correct center of perspective. Unfortunately, these pictures are generally viewed from such a distance that the eye can conveniently take in most of the picture at a glance, which is, of course, much too far for correct perspective. The result is an exaggerated sense of size, well exemplified by the familiar photographs of small steamship cabins which look like palatial rooms. It is worth noting that the close-up picture in Figure 3 looks reasonably correct if it is viewed from its center of perspective, situated in this case about three inches in front of the middle of the print.

Choice of Focal Length

The normal choice of focal length for a camera lens is therefore approximately equal to the diagonal of the desired picture size. For the picture to appear pleasant, the object should be as far away from the camera as possible, and the final picture should be enlarged if necessary to make its center of perspective fall at about 12 or 15 inches from the print. Large pictures for hanging on a wall should have the center of perspective distant by several feet, and the original angle of view should be smaller than the 50-degree maximum stated above. The chief advantage of a large *negative* over a small one is that great subsequent enlargement in printing is then unnecessary. On the other hand, if a very small depth of field is desired for some reason, then a lens of large diameter must be used, as will be shown.





3. (*top*) Distortion resulting from the viewpoint being too close when using a wide angle lens at f/22. (*bottom*) Result with a "Normal Angle" lens at f/22.

A lens of longer focus than normal, covering a small angle of field, and giving the effect of an enlargement, is now commonly referred to as a telephoto lens. Strictly, the term "telephoto lens" implies a special type of construction comprising a convex front element and a concave rear element, the arrangement being such that the focal length is greater than the distance from the front of the lens to the image plane. The advantage of this construction is that the camera extension may be substantially less than the focal length of the lens, so that a telephoto lens of 17 inches focal length may require a bellows extension of only 8 or 10 inches. In some small cameras, however, the name "telephoto" is sometimes given to lenses of normal construction which happen to have a focal length longer than the normal value for that particular camera. This practice is justified only because at high relative apertures it is possible to correct a lens of normal type better than one of the strictly telephoto type, and because great compactness is not required in such a small camera.

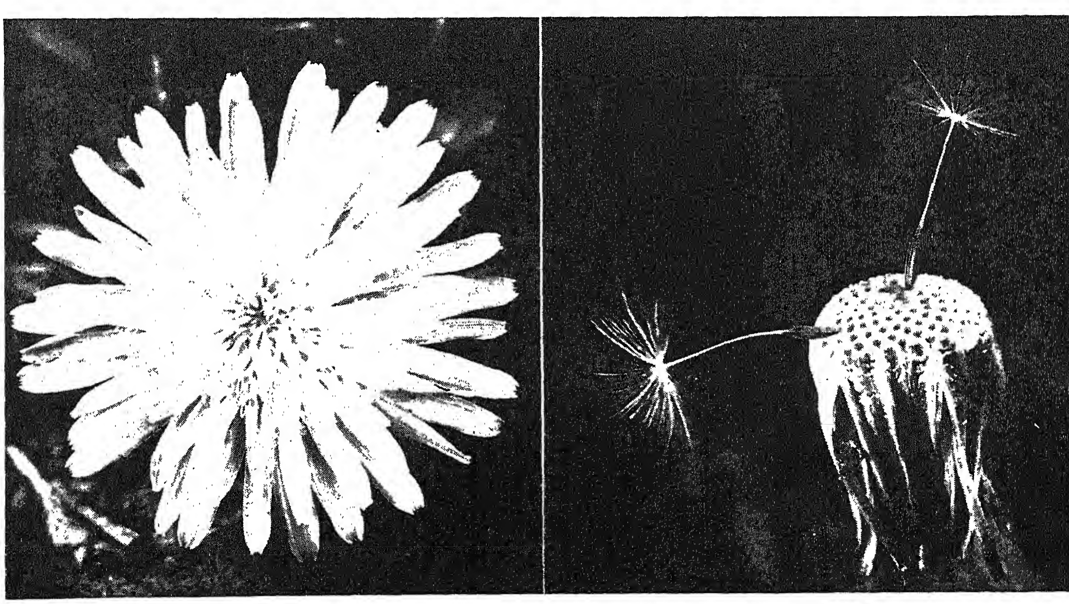
A lens covering an angle of field wider than about 50 degrees is called a wide-angle lens and, in extreme forms, such lenses have been designed to cover a field of 90 degrees to 100 degrees satisfactorily at about f/11 or f/16. There are only a few types of construction which may be used for these extreme angles of field, and none of these types can be made in high apertures. There are, however, moderately wide-angle lenses working at about f/6.3 which cover 60 degrees to 65 degrees quite satisfactorily, and these are often liked by press photographers as their use enables a wide field to be covered from a relatively close viewpoint to avoid crowds or walls or other possible obstructions.

It should be emphasized that telephoto lenses and wide-angle lenses are complete lenses in themselves, and that the f-number, depth of field, and so forth, have the same meaning as the more normal types of lens.

In choosing a lens for use on a reflex camera, it must be remembered that the "back focus," or distance from the back of the lens to the focal plane, must be great enough to allow room for the mirror in the camera. It is largely this consideration which has led to the use of focal lengths slightly longer than the diagonal of the film in most reflex cameras. The film diagonal, or "normal" focal length, for various popular sizes of pictures is given in Table I:

Table I *Length of picture diagonal, or "normal" focal length of lens.*

Picture Size (Inches)	2¼ x 2½	2¼ x 3¼	3¼ x 4¼	4 x 5	5x7
Picture Diagonal (Inches)	3.36	3.95	5.35	6.4	8.6
Picture Diagonal (mm)	85	100	136	163	218



4. DANDELION CLOSEUP. The bellows on the Speed Graphic is long enough to permit extreme closeup pictures like the above. In this case, the 4 x 5 Speed Graphic bellows was racked out to about 10¾ inches. When using a 6-inch lens this bellows length permits photographing within 12 inches of a subject. The resulting image on the ground glass is a little larger than life size. Lens stopped to f/32 and a quick bulb time exposure used. Clyde McClary Photo.

Simple Lens Formulas

A few formulas connecting object and image distances with the focal length and magnification of a lens are sometimes useful. These are given here, using the symbols:

s = object distance from lens
s' = image distance from lens
f = focal length of lens
m = magnification

$$\text{Then: } \frac{1}{s'} = \frac{1}{f} - \frac{1}{s}. \text{ Hence } s = \frac{s'f}{s'-f};\ s' = \frac{sf}{s-f};\ f = \frac{ss'}{s+s'}$$

$$m = \frac{s'}{s} = \frac{f}{s-f} = \frac{s'-f}{f} = \sqrt{\frac{s'-f}{s-f}}$$

$$s = f\left(\frac{1+m}{m}\right);\quad s' = f(1+m)$$

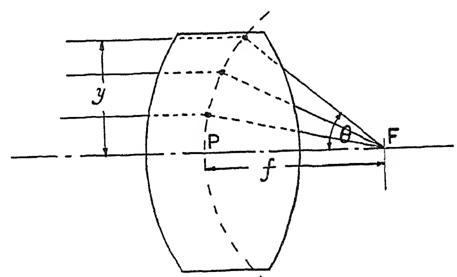
$$f = s\left(\frac{m}{1+m}\right) = \frac{s'}{1+m} = \sqrt{(s-f)\ (s'-f)}$$

The Speed of a Lens

To understand fully what is meant by the speed of a lens, we must consider the way in which a lens works when it forms an image of a distant object. To simplify the problem, we will restrict our attention to a single point in the object, which we shall suppose to be exactly on the lens axis and very distant from the camera.

The action of the lens on the various rays contained in the beam of light from this object is indicated diagrammatically in Figure 5. It will be seen that the lens has effectively bent each ray at the point where the entering and emerging portions of the ray intersect. If we then join up all these so-called "equivalent refracting points" within the lens, we obtain an "equivalent refracting surface," the axial point P of which is called the Principal Point of the lens. The point of union of all these rays after they have passed through the lens is the Focal Point F, and the distance PF is called the Focal Length of the lens. In any well-corrected lens such as a photographic objective the equivalent refracting surface is found to be part of a sphere centered about the Focal Point F.

Now when we investigate the actual flow of light from an object to its image, we find that the intensity of illumination at the center of the image of a plane object set perpendicular to the lens axis, is proportional to the ratio $(y/f)^2$, where y is the semidiameter of the lens and f is its focal length. Now by long-established custom, the ratio of the focal length of a lens to its front aperture diameter is called the f-number of the lens, thus f-number $= f/2y$. **Hence the speed of a lens is inversely proportional to the (f-number)^2, and the exposure required is directly proportional to (f-number)^2.** It should be noted that the quantity of light admitted by the lens is equal to the product of the image illumination and the time of exposure. Hence we obtain the same effective darkening of the film if we double the lens speed and halve the exposure time. Thus if we change from f:4 to f:8, we must give 4 times the exposure time to get the same ultimate film density.



5. Determining the focal length of a lens as described on this page.

It is also clear from Figure 5 that the greatest possible value of y is equal to f, when the equivalent refracting surface becomes a complete hemisphere resting with its flat side on the surface of the photographic plate. Hence the greatest speed that a well-corrected lens can possibly have is f:0.5, but this speed has never been approached in any practical lens at the present time. A cine lens has been made with a speed of f:0.85, and an astronomical

Table II

f-number	16	11.3	8	6.3	5.6	4.5	4	3.5	2.9
Relative Speed	1	2	4	6.5	8	12.5	16	21	30.5
Value of θ	1° 48′	2° 33′	3° 35′	4° 32′	5° 7′	6° 21′	7° 10′	8° 11′	9° 54′

f-number	2	1.9	1.6	1.5	1.4	1.0	0.85	0.59	0.5
Relative Speed	64	71	100	114	130	256	354	735	1024
Value of θ	14° 36′	15° 12′	18° 10′	19° 28′	21°	30°	36°	58°	90°

spectrographic lens with a speed of f:0.59. The relative speeds corresponding to a number of f-numbers are shown in Table II, taking f:16 as a speed of unity.

For convenience in mental arithmetic, it should be remembered that doubling the f-number gives only one quarter of the speed and, therefore, we must give 4 times the exposure. For this reason, the stop numbers on most lenses run in a series of steps such that each step gives half the speed of the step before it. To do this, the consecutive f-numbers must be multiplied by 1.4, the square root of 2. This gives the well-known series of f-numbers: f:1.4 2 2.8 4 5.6 8 11.3 16 23 32, each of which represents just half the speed of the one to its left in the series.

The Light Transmission of a Lens

All speed values given in Table II are based on the assumption that the transmission of the lens is unity, meaning that the whole of the entering light is used to form the image. Actually, the transmission of a lens is inevitably less than this, chiefly because each glass-air surface in the lens reflects back about 5 per cent of the light falling upon it. Hence each glass-air surface has a transmission of only 0.95, and if a lens has n glass-air surfaces, its overall transmission will be $(0.95)^n$. A few values of this transmission are given in Table III. We can see there that an f:4.5 lens having 8 glass-air surfaces has a transmission of only 66 per cent, and consequently the relative speed of this lens is only 0.66 x 12.5, or 8.25. Therefore this f:4.5 lens has an **effective** speed of only f:5.6. Similarly, a lens of the same type marked f:5.6 has a real speed of f:7, and so on.

Table III

Number of Glass-air Surfaces (n)	Useful light Transmitted $= (0.95)^n$	Amount of Unwanted Light	Ratio of Unwanted to Useful Light
2	90%	0.2%	0.2%
4	81%	1.2%	1.4%
6	74%	2.5%	3.4%
8	66%	4.0%	6.1%
10	60%	5.6%	9.4%
12	54%	7.3%	13.4%

The user need not be alarmed about the imperfect light transmission of lenses since all lenses containing the same number of glass-air surfaces have necessarily the same light transmission. The number of surfaces is either 6 or 8 in almost all of the lenses likely to be used on a Graflex or Graphic camera. In any case, the loss of lens speed due to light reflections is less than a factor of 2, or one stop on the ordinary scale, which is quite insignificant in all but color photographs.

Stray Light in Lenses

This reduction in lens speed due to internal reflection is bad enough, but the most serious consequence of surface reflection is that a fraction of the reflected light from the inner surfaces is again reflected on its way out, thus sending some unwanted light back into the camera. The total of all this unwanted light caused by double and even quadruple reflection within the lens is surprisingly great, as is shown in Table III, and in a complicated lens, this unwanted reflected light may be sufficient to lighten the shadows appreciably and give a flat uninteresting picture. An even worse cause of poor contrast in photography is light scattered from a trace of dust on the lens surface, or because the inside of the lens mount has a shiny region which ought of course to be dead black. It might be added that bubbles in the glass, although they often exist, cause no noticeable effects of any kind in the image. Some types of optical glass are known to form gradually a whitish scum on their polished surfaces due to absorption of moisture from the atmosphere. This scum can readily be wiped off, but it will surely return if the lens is used in a humid atmosphere.

Since the internally reflected light has been reflected by polished surfaces, it sometimes happens that it forms a faint but definite image of distant objects in or near the plane of the film, and if the distant object happens to be bright, for instance the sun or a bright artificial light in the field of the camera, the reflected "ghost" image may be bright enough to impress itself on the emulsion. The remedy is of course to avoid having such a bright object in the field of the camera. With some lenses too, especially when light from the sun is falling on the lens, a sharp reflected image of the iris diaphragm is projected on the film. This diaphragm image usually appears only at f:16 or thereabouts, and it may be out of focus thus causing a "flare-spot" or bright glare in the middle of the picture. At larger apertures, the picture itself becomes much brighter relative to the flare-spot, and the flare-spot itself becomes much larger, so that as the diaphragm is opened, a flare-spot will soon expand and disappear. If these phenomena exist, they can easily be seen on the ground glass under suitable conditions of observation.

Uniformity of Illumination Over the Field of a Lens

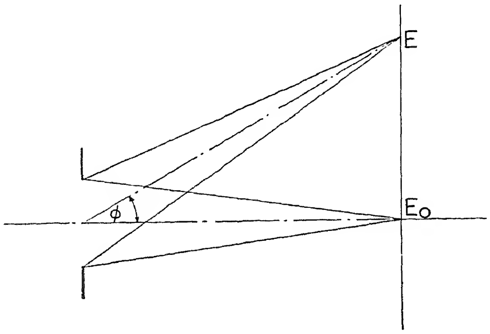
We shall consider first the case of a lens which is large enough so that the lens mounts do not cut into the beam even at the corners of the picture (Fig. 6). In this case the illumination E at the corner of the picture is less than the illumination E_0 at the center, for three reasons:

> First, the corner of the picture is farther from the lens; second, the lens aperture appears foreshortened to an ellipse when seen from the corner; and third, the light at the corner falls obliquely on to the film.

The relative illumination E/E_0 is thus found to be equal to $\cos^4 \varnothing$, where $\varnothing$ is the half field angle at the point under consideration. The value of this is given in Table IV for various sizes of the half field $\varnothing$:

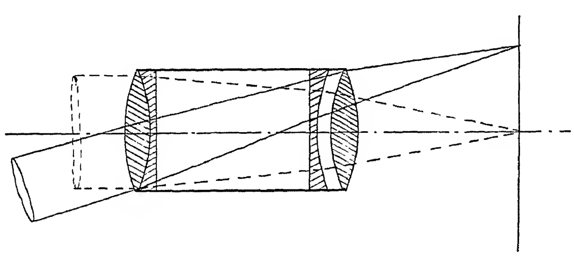
Table IV

Half Field Angle $\varnothing$	0	5°	10°	15°	20°	25°	30°	35°	40°
Relative Illumination E/E_0 (per cent)	100	98.5	96.0	87.0	78.0	67.5	56.2	45.0	34.4



6. Diagram showing the distribution of illumination over the complete film area.

If in addition to this, the lens mount also cuts into the oblique beams, the illumination over the field will fall off even more rapidly. This latter effect illustrated in Figure 7 is known as "vignetting," and is so serious in some lenses that the corners of the picture may receive only 15 or 20 per cent of the illumination at the center. Incidentally, some vignetting is very valuable to the designer of the lens as it usually acts in such a way as to cut off the rays which are hardest to correct, thus greatly improving the definition in the corners of the picture at the expense of illumination.



7. Illustrating the "vignetting" effect of a lens.

Variation of Speed with Bellows Extension

The speed of a lens varies with the bellows extension, for obviously the angle θ in Figure 5 which defines the speed of the lens will become less as the distance from lens to film is increased. It can be easily proved that if the object is placed at such a distance that the magnification is m, then the effective f-number will be equal to the marked f-number multipled by $(1+m)$, and the effective speed will be reduced by a factor $(1+m)^2$. This correction is very slight except for close objects when the bellows must be considerably extended. The effective change in speed is indicated in Table V.

The Image of a Sloping Object

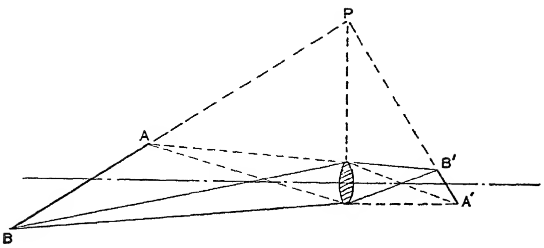
In photographing a sloping plane object, it is worth noting that the lens must also be tilted in such a way that the object plane, the image plane, and the median plane of the lens all meet, as indicated in Figure 8. Even if this is done, however, it is asking too much to expect the entire image to be perfectly sharp at the full aperture of the lens, and some stopping down is quite essential.

Depth of Field

It is of course known to all photographers that if one object is sharply focused in the camera, then there is a finite range of object distances within and beyond the focused distance which also appears acceptably in focus. Obviously this range of object distances, which is known as the "Depth of Field" (or sometimes Depth of Focus) of the lens, depends on how the lens is used, and on how the final picture is viewed. For example, if a print is examined under a magnifier, many objects will appear noticeably blurred, although these same objects may appear quite satisfactorily sharp when the print is viewed directly.

Table V

Object Distance in Multiples of Focal Length		∞	100	50	10	5	4	3	2
Magnification m		0	.01	.02	.11	.25	.33	.50	1.00
Relative Speed		1	.98	.96	.81	.64	.56	.44	.25
Equivalent f-number when Stop is Marked:	f:3.5	3.50	3.54	3.57	3.89	4.38	4.82	5.29	7.00
	f:4.5	4.50	4.54	4.59	5.00	5.62	6.01	6.78	9.00
	f:8	8.00	8.08	8.16	8.89	10.00	10.69	12.10	16.00



8. The image of a sloping object AB resulting in the film plane at A'B'.

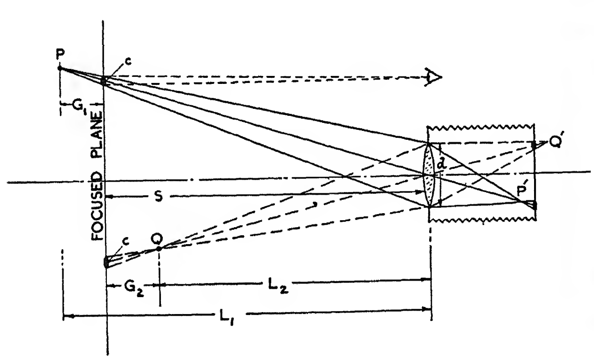
The simplest way to regard depth of field is to consider that the film will record faithfully everything existing in a certain "focused plane" lying in the object space. An object-point P lying outside this focused plane will be projected on to this plane as a small circle of diameter c (Fig. 9), and thus the point P will be pictured as a small "circle of confusion" on the film, the circle on the film being the image of c formed by the lens. If the final picture is then viewed correctly from its center of perspective, the appearance will be the same as if the original focused plane were viewed from the center of the taking lens.

Now the human eye can just detect the presence of a small circle of confusion on a photograph if it has a diameter greater than about 1/1000 or 1/1500 of its distance from the eye. Thus our circle of confusion c in the focused plane may reach s/1000 or s/1500 before becoming noticeably different from a perfect point. Taking the larger figure, s/1000, as acceptable in most cases, we can work out values for the two parts of the depth of field, namely:

$$G_1 \text{ (beyond focused plane)} = \frac{cs}{d-c} = \frac{s^2}{1000d-s}$$

$$G_2 \text{ (within focused plane)} = \frac{cs}{d+c} = \frac{s^2}{1000d+s}$$

These values represent the range of object distances beyond and within the focused plane which will appear acceptably sharp on the final photograph when it is viewed from its correct center of perspective.



9. Depth of field—fully described in the text on this page.

The corresponding distances of the limits of the depth of field, when measured from the camera lens itself, become:

$$L_1 = s + G_1 = \frac{1000ds}{1000d-s}$$

$$L_2 = s - G_2 = \frac{1000ds}{1000d+s}$$

The Hyperfocal Distance

These expressions for the depth of field of a lens can be simplified by introducing the idea of "Hyperfocal Distance." This is defined as that object distance on which the camera must be correctly focused in order that the far limit of the permissible depth of field shall just reach to infinity. Alternatively, if a camera is correctly focused on infinity, the hyperfocal distance becomes then the nearest distance that is just acceptably in focus.

To determine this distance, we merely have to write $G_1 = \infty$, when we find that the hyperfocal distance h is equal to 1000d, or a *thousand times the diameter of the lens aperture as seen from the front of the camera.*

9a. BRONC . . . fast action at a western Rodeo. Fall sunlight at 4 p.m. 1/550 second, f:11, Fast Pan Film, 4 x 5 Speed Graphic . . . Ralph Forney photo.

If a lens is correctly focused on its hyperfocal distance, then the far-depth of field extends to infinity as we have seen, and the near-depth of field becomes just half the hyperfocal distance. Thus, with a lens of 0.75 inch front aperture, $h = 750$ inches or 62 feet, and the acceptably focused range runs from 31 feet to ∞.

We may now express our depth of field formulas in terms of the hyperfocal distance h, which is 1000d as we have seen. Then we find:

$$G_1 = \frac{s^2}{h-s} \qquad G_2 = \frac{s^2}{h+s}$$

and

$$L_1 = \frac{hs}{h-s} \qquad L_2 = \frac{hs}{h+s}$$

From these last two formulas we can derive another useful formula which gives us the distance on which we must focus our camera in order that the depth of field should just extend over some specified range. Suppose we wish to photograph objects lying between the two distances L_1 and L_2, we must focus our camera on the intermediate distance s given by $s = \frac{2L_1L_2}{L_1+L_2}$. Thus, if we wish to photograph sharply all objects lying between 20 and 10 feet, we must focus the camera on the distance $s = \frac{2\times10\times20}{10+20} = 13.3$ feet. The hyperfocal distance in this case is given by:

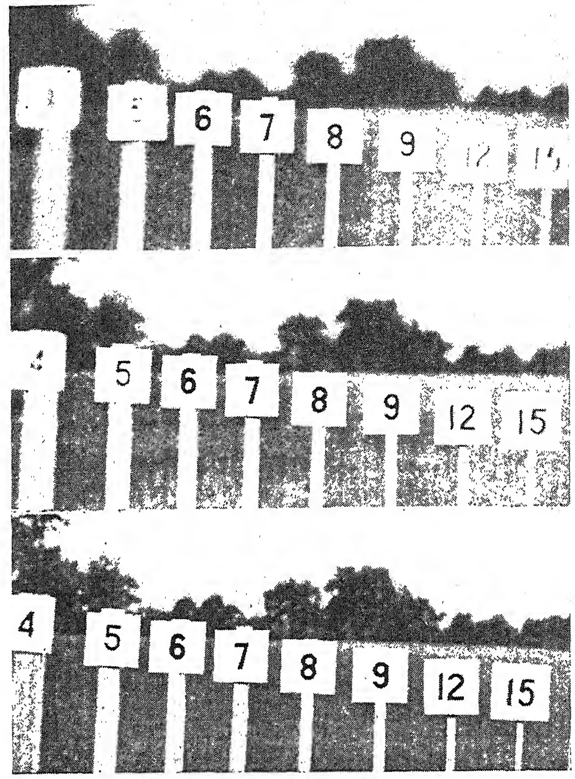
$$h = \frac{2L_1L_2}{L_1-L_2} = \frac{2\times10\times20}{10} = 40 \text{ feet}$$

corresponding to a lens of diameter 40/1000 feet or .48 inches. This diameter is obtained, for example, at a relative aperture of f:8 with a 4-inch lens.

Table VI

Hyperfocal distances = 1000 times lens aperture (in feet)

Focal Length (inches)	f-number								
	2.9	3.5	4.5	5.6	6.3	8	11	16	22
3	88	72	56	45	40	32	23	16	12
5½	158	131	102	82	73	57	42	29	21
6	172	143	111	89	79	62	45	31	23
6½	187	155	120	97	86	68	49	35	25
7	201	167	130	104	93	74	52	37	26
7½		179	139	112	99	78	57	39	28
8½		202	157	126	112	89	64	44	32
10		238	185	149	132	104	76	52	38
11		262	204	164	145	115	83	57	42
12		286	222	179	159	125	91	62	45
14			259	208	185	146	106	73	53
15			278	223	198	156	114	78	57
17			315	253	225	177	129	89	64
20			370	298	265	208	152	104	76

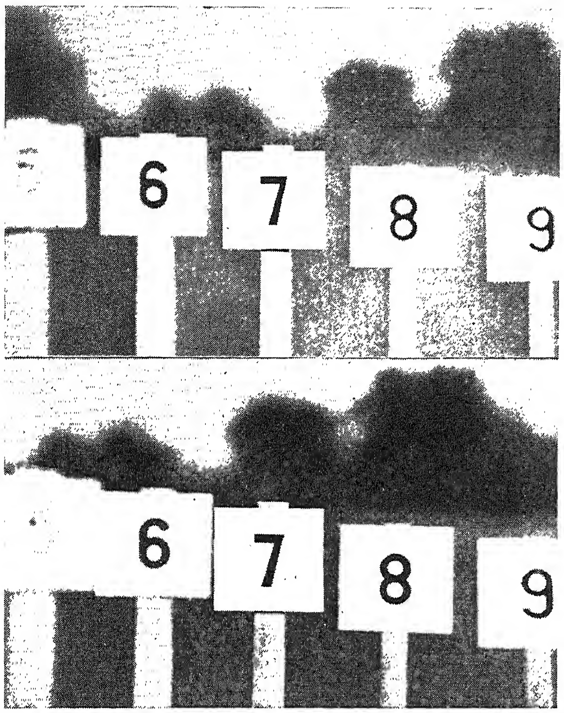


10. Distance targets photographed with a 6-inch lens. Camera focused at 7 feet for each photograph. Top to bottom, diaphragm openings of f:4, f:8, f:16.

It will be clear from what has been said that, **provided the final picture is viewed from its correct center of perspective**, the depth of field will depend **only** on the diameter of the clear aperture of the taking lens and the distance of the object (Fig. 10). (This diameter may be found by dividing the focal length by the f-number.) Hence an f:8 lens of 6 inches focal length has the same depth of field as an f:4 lens of 3 inches focal length, since in both cases the lens aperture is 0.75 inch.

If the print should happen to be viewed from a distance of two or three times the correct viewing distance, then the depth of field becomes magnified two or three times respectively. This commonly occurs in small snapshots when they are viewed at a distance of 10 or 12 inches from the eye.

It should be noticed that the size of the circle of confusion on the plate or film corresponding to the largest acceptable limit of unsharpness as defined above, is equal to 1/1000 of the focal length of the lens. This amounts to 1/10mm for a 100mm (4-inch) lens. Hence lenses made to the same formula and f-number in various focal lengths all give equally satisfactory sharpness of definition, provided each print is viewed from its correct center of perspective; the depth of field of the vari-



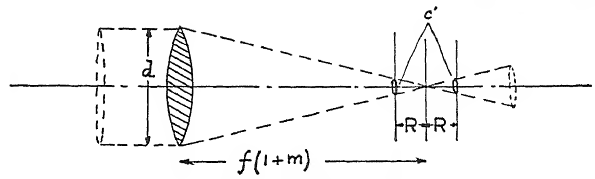
10a. Distance targets photographed with lens having an effective aperture of 1½ inches. Top photograph made with 6-inch lens at f:4, bottom view with 12-inch lens at f:8 opening. Effective aperture in each case was the same, 1½ inch.

ous lenses will then vary inversely as the lens diameters. This is one of the real advantages possessed by the miniature camera. For example, an f:2.5 lens of 6 inches focal length has a diameter of 2.4 inches, and the depth of field when the camera is focused on a distance of 10 feet is given by $G_1 = 6.3$ inches beyond, and $G_2 =$ 5.7 inches within, or a total depth of just 12 inches. On the other hand, an f:2.5 lens of 2 inches focal length has a diameter of 0.8 inches, and then $G_1 = 21.2$ inches and $G_2 = 15.7$ inches, or 37 inches altogether.

Consequently, reducing the focal length from 6 inches to 2 inches, has increased the depth of field by 3 times, but has not affected the speed of the lens in any way.

Depth of Focus: The Precision Required in Focusing a Camera

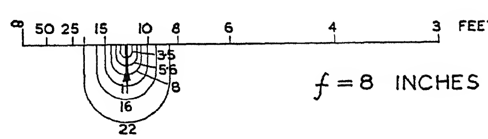
The name Depth of Focus (or sometimes Depth of Definition) is commonly given to the definite small range of positions that the film may occupy without the image becoming noticeably out of focus. Suppose we can tolerate a circle of confusion c′ on the negative, then the amount R by which the film may be out of focus is equal to c′ multiplied by the effective f-number of the lens (Fig. 11). Since by our assumption that the picture should always be viewed from its center of per-



11. Diagram showing the depth of focus as described on this page.

spective, c′ is equal to f/1000, and as the f-number at any object distance is given by $f(1 + m)/d$, we see that $R = f^2 (1 + m)/1000d$. Since the magnification m is equal to $f/(s - f)$, we see that $(1 + m)$ is equal to $s/(s-f)$, and thus in the case of an f:2.5 lens of 4 inches focal length, used with an object at 10 feet distance, the lens diameter d is 1.6 inches, and the magnification m is equal to $4/116 = .0345$. Thus in this case the depth of definition is $\pm R = 4^2 (1.0345)/1600 = .0104$ inches or 0.26mm. This indicates the degree of precision required in focusing a lens of such a high relative aperture as f:2.5. It also gives us an indication of the necessary film flatness when such an extreme lens is used.

An interesting adaptation of the foregoing is the addition of a depth-of-field scale to the focusing scale of a camera. The justification of this procedure follows from the formula derived above, as it can readily be shown that the distance from the ∞ mark to the focused plane is approximately equal to f^2/s; from the ∞ mark to the farthest end of the depth-of-focus range is f^2/L_1; and to the nearest end of this range is f^2/L_2. Now since $L_1 = hs/(h-s)$ and $L_2 = hs/(h+s)$, we find a constant interval equal to f^2/h or $f^2/1000d$ between the points on the focusing scale corresponding to the focused plane and each of the two limits of the depth-of-field range, which interval is quite independent of object distance. Thus a scale-pointer such as is sketched in Figure 12 is applicable for all object distances. The depths of field given here are of course those which occur when the print is viewed from its correct center of perspective. If the viewpoint is twice as far as it should be, the depths will of course all be doubled; hence these figures may be regarded as erring on the severe side for small cameras.



12. A focusing scale pointer with depth-of-field calibration as described above.

Sharpness of Definition: Resolving Power of Lenses

The resolving power of a lens may be briefly described as its power of separating the images of closely spaced parallel lines, the width of the line being equal to the

width of the spaces between adjacent lines. A lens is, therefore, said to have a resolving power of 20 lines per millimeter if, under suitable experimental conditions, it is possible to record on the film definitely separated lines and spaces having this separation.

Table VII

Resolving Power of a Perfect Lens

f-number	1.5	2	2.8	4	5.6	8	11.3	16
Theoretical Resolving Power (lines per mm)	1190	890	640	450	320	220	160	110

If a lens forms a very clear and well-defined image, the resolving power of the lens may easily become so high that the size of the film grain enters into the problem. Graininess and light scattering in a film will obviously tend to spoil the resolution of the lens itself, and ultimately the resolving power of a given combination of lens and film may be limited entirely by the film, and not by the lens at all. In Table VIII the measured resolving powers of some standard film types are listed, the resolving power being that of the film in question when used with a very highly corrected f/5 telescope objective, under optimum exposure and development conditions, with a test object having 30:1 contrast.

It is possible to make a combination of lens and film which has a resolution of over 100 lines per millimeter over a 40-degree field. However this refers to a special highly corrected low-aperture lens used with a rather slow extra fine grain film; in practical photography resolutions of higher than 40 or 50 lines per millimeter are fairly hard to obtain. In all lenses the resolution is found to be best on the axis, and to diminish steadily at greater obliquities where the lens aberrations are greater. In the presence of unsymmetrical aberrations such as coma and astigmatism, the resolving power at a given obliquity may, of course, be greater in one direction than in another.

It should be added that even if we could obtain grainless film and perfectly corrected lenses, the finite wave length of light would act to provide a final limit to the possible resolution obtainable. It can be shown from the theory of light that the image of a fine line of light consists of a slightly broadened line, bordered on each side by a series of progressively fainter parallel bands of light and darkness, as indicated in Figure 13. The width of this image is directly proportional to the f/ number of the lens. Hence, if the original object consists of two closely adjacent narrow parallel bands of light, the light distribution across the image will be found by adding together the light intensities from both sources, as indicated in Figure 14. In this case, experiment shows that under a suitable high magnification, we can just detect *visually* that there are two lines present instead of one, if the mid-way intensity is less than about 80 per cent of the peak intensity of each line image. This occurs when the two line images are separated by a distance of $1.2\lambda f/d$. Thus, for a wave length (λ) of .0005 mm, we can draw up a table of theoretical visual maximum resolving powers of perfectly corrected lenses (Table VII). No lens or lens-and-film combination can possibly give a higher resolution than the value indicated in this table.

In ordinary photography, the realization of high resolution requires a contrasty subject, and very carefully controlled exposure and development conditions. Absolute stillness of the camera is essential and the focus must be perfectly adjusted.

The resolving power of a *print* depends mostly upon the resolving power of the observer's eye. For instance, an observer whose eyes are capable of resolving structures subtending an angle of 1 in 1000, can just resolve 5 lines per millimeter when viewed at a distance of 200mm (8 inches). This may, therefore, be regarded as the useful resolving limit in the final print. Consequently, a negative intended to be viewed at 8 inches distance after an enlargement of 10 times, would need a resolving power of at least 50 lines per millimeter.

Our final conclusion from this study is that under ordinary conditions with good lenses used at an aperture greater than about f/11, the lens image is likely to resolve better than the emulsion, especially if further reductions in resolution due to accidental movements or errors in focusing are included also.

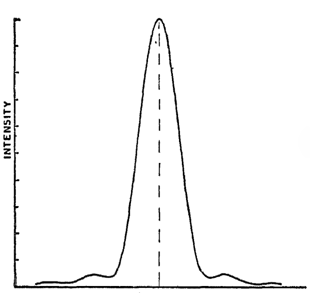
Since all practical lenses represent the result of a compromise between aperture, field, corner illumination, and cost of manufacture, it is unreasonable to expect a lens to work best at full aperture. A common rule, which is fairly representative of many current types of lenses, is that a lens will perform best at an f-number about twice the f-number of the full aperture. That is, an f/4.5 lens might be expected to give its best overall performance when stopped down to about f/8. In good lenses, however, the improvement in definition to be gained by this stopping down can only be detected by very stringent and exacting tests. Stopping down reduces vignetting and increases depth of field.

The Manufacture of Lenses

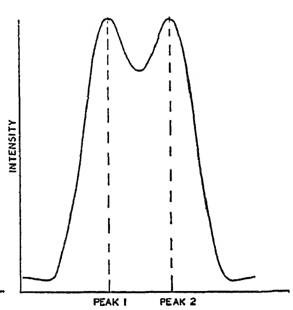
Photographers often ask why it is that photographic lenses are so expensive, but they would not ask that question after visiting a modern lens factory. From the point of entry of the optical glass, which alone costs between $1.00 and $30.00 a pound, to the final inspection and wrapping of the lens for sale, all the processes involved are delicate and troublesome, and can be done only by skilled operators. In addition to this direct factory cost, there is the very great designing expense, including the making of perhaps several test samples, factory samples, and so forth, and often the altering and modification of the design until it is acceptable.

Table VIII
Measured Speeds and Resolving Powers of some Eastman Emulsions

Emulsion	Kodak Speed Daylight	Kodak Speed Tungsten	Resolving Power (lines per mm.)
Film Packs:—			
Panatomic X	125	80	55
Verichrome	160	80	45
Super XX Pan	400	320	50
Sheet Film:—			
Portrait Pan	200	125	40
Super XX Pan	320	200	50
Super Ortho Press	400	200	55
Ortho-X	500	250	40
Super Panchro Press	500	400	50
Tri-X Pan	640	500	40
Plates:—			
Wratten Panchromatic	64	40	55
Ortho Press	200	100	50
Super Panchro Press	400	320	50



13. Cross section showing light distribution across the image of a single thin line of light as described in the text.



14. Cross section showing resolution of two close lines of light. Central intensity is 0.8 of peak intensity. See text for full explanation.

When the design has been decided upon and a sufficient supply of glass is obtained, the work may be begun. The glass is first cut into pieces of about the right weight, which are then heated to redness and pressed out to approximately their final shape. The pieces are reheated and very slowly cooled so as to anneal them and remove all signs of internal strain. The annealed blanks are then blocked together several at a time, by sticking them with pitch to a metal "body" in such a way that their curved outside faces all lie in the same spherical surface ready to be ground and polished.

Grinding is then performed in several stages, using successively finer and finer emery with water, until the thickness is right, and the surface is smooth and free from scratches. The emery is washed off, and the lenses are polished, still on the "body," with rouge and water, on a pitch-lined polisher made to the same radius of curvature as the fine grinding tool, which radius is of course equal to the radius of curvature desired on the finished lenses. Polishing is completed in an hour or two, and then the lenses are knocked off and reblocked upside down ready to grind and polish the rear surfaces. When both surfaces have been polished, they are tested for radius and true sphericity by the use of "Newton's rings" or interference colors, by which means surface irregularities of 1/100,000 inch may be detected. Each lens is then mounted in turn on a lathe spindle so as to turn truly about its optical axis, and the edge is ground down to its final diameter.

Not all the cost of a lens is in the glass work, since in many lenses the mounting may cost as much as or more than the optical work, especially in focusing mounts which are fitted with a beautifully made multiple thread, not to mention such accessories as the iris diaphragm and the shutter! In mounting a lens, the greatest care must be taken to maintain the correct separation between lens elements, and to be sure that no lens is tilted in any way. Sometimes two or more of the lens elements must be cemented together with Canada balsam. Even when completely assembled, the final inspection of the lens on the optical bench may cause further rejections, because the combined effect of many defects, separately insignificant, may cause the image to be too bad to be acceptable.

Choice of Lens

Wherever possible, it is well to discuss the selection of a Graflex or Speed Graphic camera with the manufacturer or dealer before completing the purchase, to be sure that the lens you choose will meet your requirements. If this is impossible, a summary of the points discussed may be of value.

First, there is the question of speed. Most everyday outdoor pictures are taken at perhaps f:6.3 or f:8 or less, and the precise choice of maximum aperture is a matter of some indifference, except that an f:3.5 lens stopped down to f:8 is likely to give poorer definition but better uniformity of illumination than an f:4.5 lens stopped down to f:8. However, under difficult conditions such as in poor light or when photographing moving objects where the greatest possible lens speed is desirable, it is well to realize that the f:3.5 lens is 1.7 times as fast, and the f:2.9 lens is 2.4 times as fast as the f:4.5 lens (see Table II, page 46).

Second, there is the choice of focal length to be considered. In Graflex and all types of reflex cameras the distance from the lens board to the film plane is limited by the construction of the camera, and the lens must not project too far behind the lens board or it may obstruct the motion of the mirror. The following table gives the shortest distance from lens mounting ring (front of lens board) to the focal plane which can be accommodated on various Graflex cameras:

Table IX

Minimum Flange-to-Film Distance	Inch
Series D Graflex (3¼ x 4¼ inch)	5 11/16
Series D Graflex (4 x 5)	6¾
RB Auto Graflex (3¼ x 4¼)	7⅛
RB Auto Graflex (4 x 5)	8¼
RB Home Portrait (5 x 7)	9¼
Speed Graphic (all)	2⅜

The lens chosen and listed by the manufacturer may have a focal length greater than this distance, but this is required by the size and type of mounting of the lens in order to permit the mirror to swing clear. These focal lengths are somewhat longer than the diagonal of the picture. In the Speed Graphic cameras there is virtually no lower limit to the focal length that may be used. At the other extreme, telephoto lenses of focal lengths up to 24 inches can be fitted, because in these lenses the flange-to-film distance is much less than the focal length.

As regards make of lens and price to be paid, that is largely a matter of personal preference or prejudice, and the average purchaser can be confident that any lens listed by the camera manufacturer for use with a Graflex or Speed Graphic camera will give him entirely satisfactory results; and if a lens should be found for some reason to yield inferior images, the trouble will be rectified at once by the maker. In general, lenses of short focus cover a wide field, but give a small-scale picture; and lenses of long focus give a magnified view of the central part of the field.

However, a long-focus lens has a larger diameter than a short-focus lens of the same f-number, and hence will have less depth of field. This implies that if great depth is required, as short a focus and as low an aperture as possible should be chosen; but if small depth is desired, as in portraiture or to minimize the effect of an undesirable background, then a wide-aperture lens of long focus and low f-number should be chosen.

Lens Mounts

The simplest type of lens mount is a plain barrel, with the necessary iris diaphragm mounted in its correct position within the lens. This is shown in Figure 16 (upper right). The mount in this case is screwed into a ring or "flange" on the lensboard with most of the lens projecting beyond the front of the camera. If this is found to be inconvenient, the "sunk type" barrel mount may be used in which the ring or flange for the lensboard is situated near the front of the lens, and the iris diaphragm operating ring is carried to the front also. This is shown in the upper left in Figure 16.

If a between-lens shutter is desired, there is a number of types available shown in Figure 16, and identified in the caption beneath it. The illustration shows the earlier models of Compur shutters, now obtainable only in certain sizes, alongside with the most modern, latest types of between-the-lens shutters, such as the Rim-set Compur shutter with self-timing device, Rim-set shutter of the Press Compur type, Rim-set Compur Rapid shutter with self-timing device, which reaches speeds up to 1/400 of a second. Of special interest should be the latest Supermatic shutter with Press-Focusing button, in which the shutter may be opened for focusing on the ground glass without changing the shutter speed setting, by the use of a special lever provided. The shutters equipped with the so called "self-timer" provide the delayed action feature desired by photographers who wish to appear in the photograph, after setting up the camera for the picture.

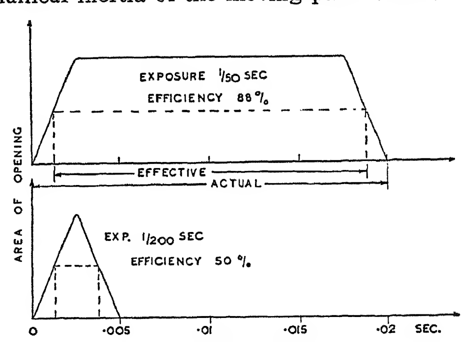
Every between-lens shutter is also equipped with an iris diaphragm for changing the aperture, and hence the speed and depth of field, of the lens. Although mounted in the same case, the iris and shutter mechanisms are entirely separate and distinct, and are only placed together for convenience and because in many lenses there is only one air space sufficiently wide to insert the leaves of a shutter or diaphragm. Moreover, if there were an appreciable distance between the iris and the shutter blades, the two apertures would vignette each other, resulting in a diminution in exposure at the corners of the picture as compared with the center.

For some types of cameras, the lens is supplied in a sunk barrel equipped with a multiple-thread focusing device by means of which the lens as a whole can be moved back and forth relative to the lens board of the camera. This is unnecessary on those cameras such as the larger Graflex and the Speed Graphic in which the entire lens board itself is moved for focusing, but the National Graflex cameras being more compact require a lens in focusing mount.

Choice of Shutter

The Graflex camera is equipped with a focal plane shutter, while the Speed Graphic is provided in addition with a between-lens shutter, and the user is often puzzled to know in what ways one type of shutter may be preferable to the other.

If a between-lens shutter could be made to open instantaneously to its full aperture, remain open for the required time, and then instantaneously close again, it would be ideal for all purposes. Actual shutters of this type usually behave somewhat in this ideal manner for the very long exposures, say longer than about 1/5 second. For exposures shorter than that, however, the mechanical inertia of the moving parts causes the shutter blades to open relatively slowly and to close slowly. so that the curve of open area against time is approximately of the form shown in Figure 15. Thus the amount of light passed by the shutter in say 1/100 second is less than would be given if the lens were held fully open for 1/100 second and then suddenly closed again. The ratio of the actual quantity of light admitted by the



15. Efficiency of a between-the-lens shutter. It will be noted that a higher efficiency is obtained at the slower exposure as described in the text.

shutter to the ideal amount is called the "efficiency" of the shutter, and in some types of between-lens shutter at the shortest exposures, efficiencies as low as 40 or 50 per cent may be found. Moreover, it is very hard to construct a shutter mechanism which will not suffer from undue wear when it is operated by a powerful spring such as is necessary for the 1/200 or 1/400 second exposures.

The roller blind shutter, on the other hand, because of its simple and rugged mechanism will give brief exposures of 1/1000 second with accuracy and constancy, but unless provided with a special additional delay mechanism it will not allow of longer exposures than perhaps 1/15 or 1/20 second. Also, since the shutter slit traverses the plate from one end to the other, very rapidly moving objects appear to lean, because one end of the object will have moved slightly before the other end has been photographed.

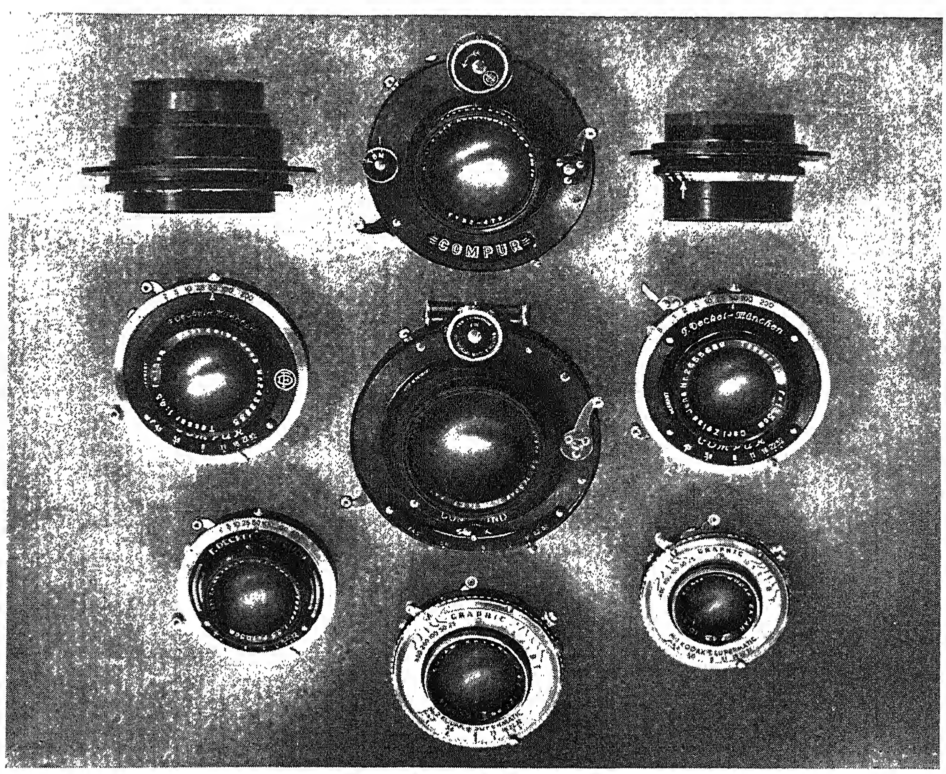
Lens Attachments

The most common type of supplementary lens is the familiar Portrait Attachment, consisting of a simple, rather weak positive landscape lens which is placed in front of the regular camera lens to enable near objects to be focused without the necessity of racking the lens so far forward. The opposite kind of attachment is sometimes used, namely a weak concave lens. This lengthens the lens focus, and necessitates a quite considerable increase in the camera extension; the net result is of course a somewhat enlarged image. Another useful attachment is the diffusing disc, which is generally used on enlargers to introduce a little softening of the lens contrast and definition. There are a number of "soft-focus" lenses made for portraiture, and also some regular portrait lenses in which the definition may be softened by adjusting the position of one of the elements in the lens. At the moment, the craze for excessively soft-focus portraits is going out of fashion; indeed, it seems now that no picture can be sharp enough.

Enlarging Lenses

It is a very common practice to use regular photographic lenses on enlargers, and generally this is perfectly satisfactory. It is worth noting, however, that a photographic lens is ordinarily designed for use with a very distant object, and if such a lens is used at a magnification of 2 to 1, or 3 to 1, in an enlarger, the flatness of field may suffer. Moreover, bromide printing paper is sensitive only to the extreme blue and near ultraviolet, whereas photographic lenses are often corrected for the yellow and blue regions of the spectrum.

One of the most desirable features of an enlarging lens nowadays is good correction for lateral chromatic aberration, or chromatic difference of magnification,



16. Nine types of lens mounts: (*Top row, left to right*): Lens in sunk mount or recessed barrel mount . . . Dial-set Compur shutter . . . Lens in normal barrel mount. (*Second row, left to right*) : Rim-set Compur shutter with self-timing device . . . Compound shutter . . . Rim-set shutter of the Press-Compur type. (*Bottom row, left to right*) : Rim-set Compur-Rapid shutter with self-timing device . . . #2 Supermatic shutter with Press-Focus button . . . #1 Supermatic shutter with Press-Focus button.

especially at a magnification of about 4 to 1. This is because of the increasing use of enlargers to make 3-color separation negatives from Kodachrome film, and the results would of course be very unsatisfactory if the different colored superposed pictures were of slightly different sizes. This defect is a particularly serious one since it cannot be ameliorated by stopping the lens down.

To test for the presence of this aberration, a negative consisting of a blackened plate with a clear line cut in it along one end of the plate, may be projected by means of the enlarger upon a panchromatic film at the desired magnification. Pieces of thin red, yellow, green, and blue gelatin filter are placed behind portions of the clear white line on the object plate, and of course any lateral color will be revealed by the image of this line being discontinuous on the photograph.

SUMMARY:

In choosing a lens for a Graflex or Speed Graphic camera, we must first decide on the focal length and aperture. For reasons of perspective, the focal length chosen will ordinarily be a trifle longer than the diagonal of the picture, as indicated in Table I, Page 45. Pressmen commonly prefer somewhat shorter focal lengths, to clear crowds and other obstructions, and they should therefore not expect perfect corner definition at full aperture.

Lenses with focal length much shorter than normal are called wide-angle lenses. Their use may lead to an appearance of exaggerated size, especially of close objects, due to the difficulty of viewing the prints from their correct center of perspective. Remember that lenses of very short focus cannot be used on a Graflex camera because of the tilting mirror.

Lenses with exceptionally long focus give enlarged pictures, and are especially useful with distant or inaccessible objects. A special type of long-focus lens is the "Telephoto" lens, convenient because of the comparatively short bellows extension required.

For ordinary purposes, a speed of f/4.5 is sufficient. It should, however, be remembered that an f/3.5 lens is 1.7 times as fast as an f/4.5 and f/2.9 lens is 2.4 times as fast as an f/4.5.

Depth of field ordinarily depends only on the distance of the object, and the clear linear aperture of the lens (focal length divided by the f/ number). Thus, to secure great depth of field, a *high* f/ number and a *short* focal length are desirable. If a *small* depth of field is desired, a large lens-opening must be used, obtainable by means of a long focus and a low f/ number.

HOW TO USE FILTERS

JOHN W. McFARLANE

All of us have seen and enjoyed magnificent landscape photographs, and we have admired the clear pictures which sometimes help to make our magazine advertising more interesting than magazine stories. The effectiveness of many of these pictures may be attributed to filters. On the other hand, filter use is no substitute for good photography. We all have met the filter fiend who blames his photographic failures on his choice of filter, and who perhaps burdens himself with dozens of filters and attempts to use every one. Between this extreme and the filterless perpetration of bald skies, there lies a wise middle course in the use of filters. Furthermore, filters are for only those who have attained proficiency in producing properly exposed, sharp negatives which print well.

How Does a Filter Work?

The action of a filter is to stop light of certain colors. That is, rays of some colors are allowed to pass through freely, while others are partially or wholly absorbed. This is the fundamental concept of a filter, and should be kept in mind whenever a filter is to be used.

Because a filter selectively absorbs certain rays, it necessarily appears colored. A red book appears red because it *reflects* red light and *absorbs* light of other colors. A red filter appears red because it absorbs green and blue light and transmits red light freely (see Fig. 4). A filter which absorbs red and green light appears blue. Looking through such a filter, red and green objects appear dark, while blue objects appear light. A filter which absorbs blue and red is green; one which absorbs only blue appears yellow because it transmits green and red light, and these affect the eye as yellow. Since the most used photographic filter reduces the amount of light in the blue region of the spectrum without appreciably reducing light of other colors, it appears yellow (see Fig. 3). However, all yellow transparent substances are not suitable as filters, because some may transmit freely the ultraviolet and yet appear identical to others which absorb it completely. Filters which do this are valueless for photography.

Filters and the Spectrum

When a beam of white light is separated into a *spectrum* by a prism, the interrelation of the colors is shown in Figure 1. The wavy lines indicate their wave lengths, and the figures (700 mμ, etc.) give the wave length in millimicrons or millionths of a millimeter. Wave length is mentioned because light behaves in a wave-like manner, and is just one member of the great spectrum shown in Figure 2, and because the appearance of color is due solely to the effects of the various wave lengths on the eye.

The action of two common filters is shown in Figure 3 and Figure 4. The yellow filter, K2, lets through all visible light except blue. At first glance this seems strange, because the pure yellow part of the spectrum is a very narrow one lying between red and green. This is explained by the mechanism of our color vision, which appears to operate on three sets of light-sensitive retinal elements, responding to blue, green, and red light. Spectral yellow appears the same as a mixture of red and green, because both stimulate the visual red and green-sensitive elements to about the same extent.

Other filters allow other parts of the spectrum to pass. In some cases, the spectrum is diminished gradually by the filter, and in other cases, it is terminated abruptly. These effects are shown by "spectrograms." A spectrogram is obtained by exposing the film to a spectrum, which has been modified by a gray glass wedge so that one edge of the spectrum is bright and the other is dim. The result is a curved figure, highest where fell the part of the spectrum to which the film was most sensitive. A scale plate in front of the film during exposure prints wave length figures on it. The number 46 refers to 460 mμ, etc.

What Are Spectrograms?

For the purpose of measuring and showing color sensitivity and so on, an instrument known as a spectrograph is used (see Figure 5). It analyzes white light into a spectrum, as shown in Figure 1. The film to be tested is placed where the spectrum is formed. A scale with

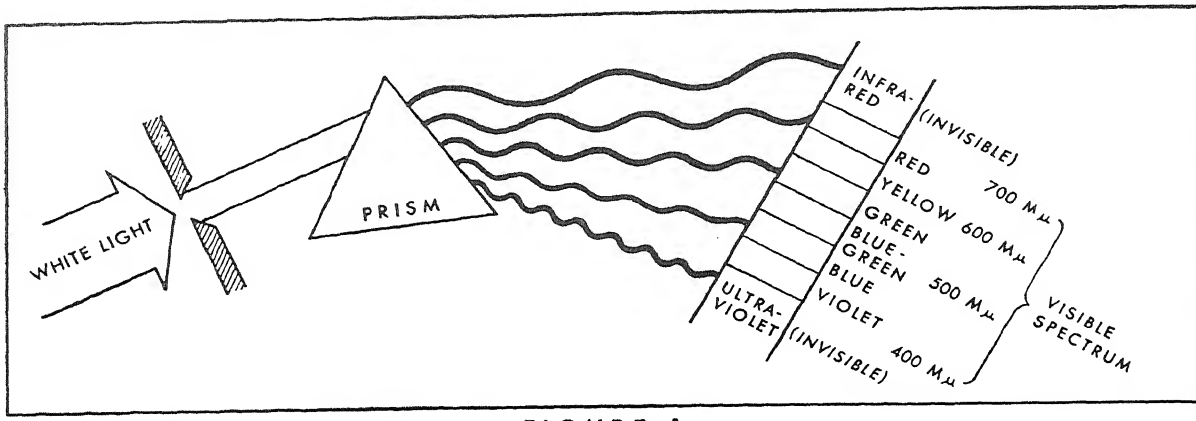


FIGURE 1.

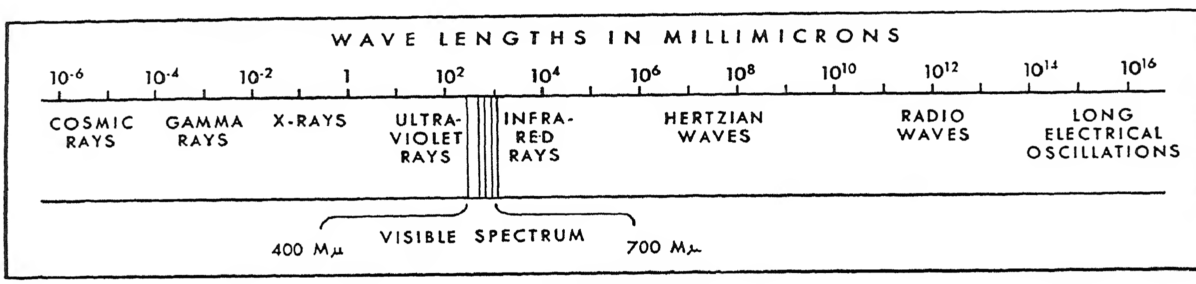


FIGURE 2.

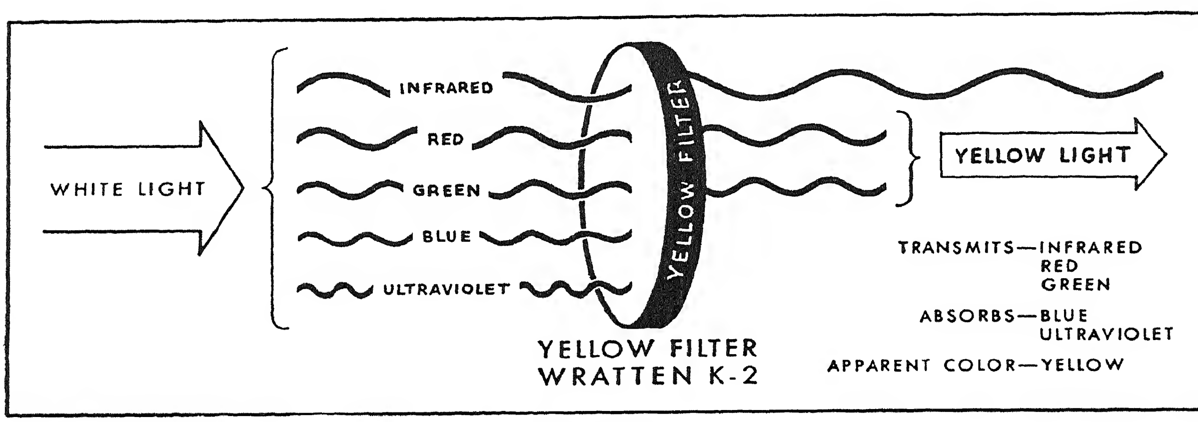


FIGURE 3.

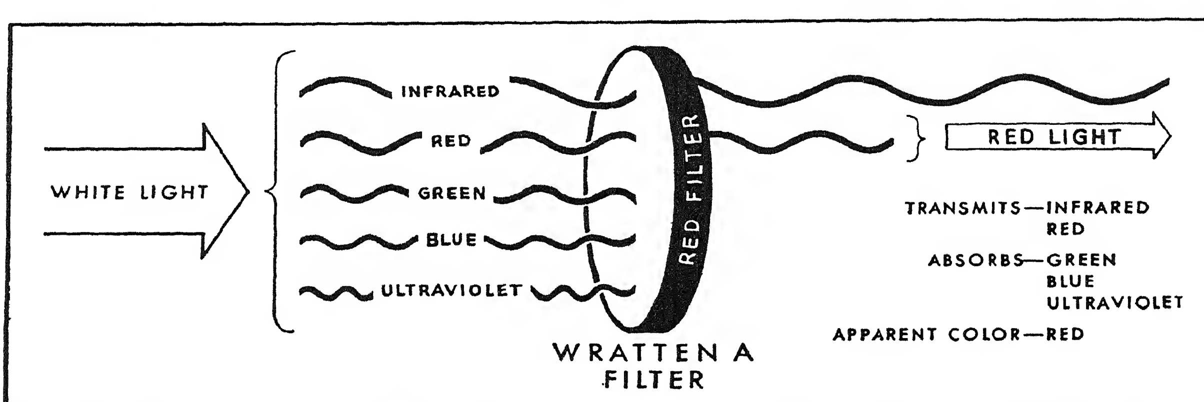
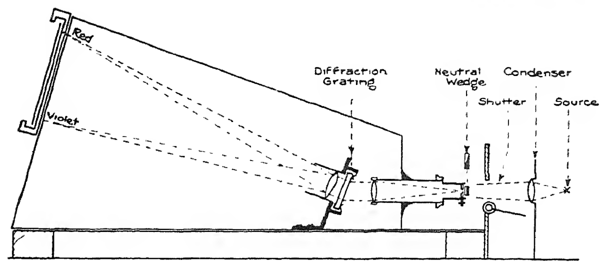


FIGURE 4.

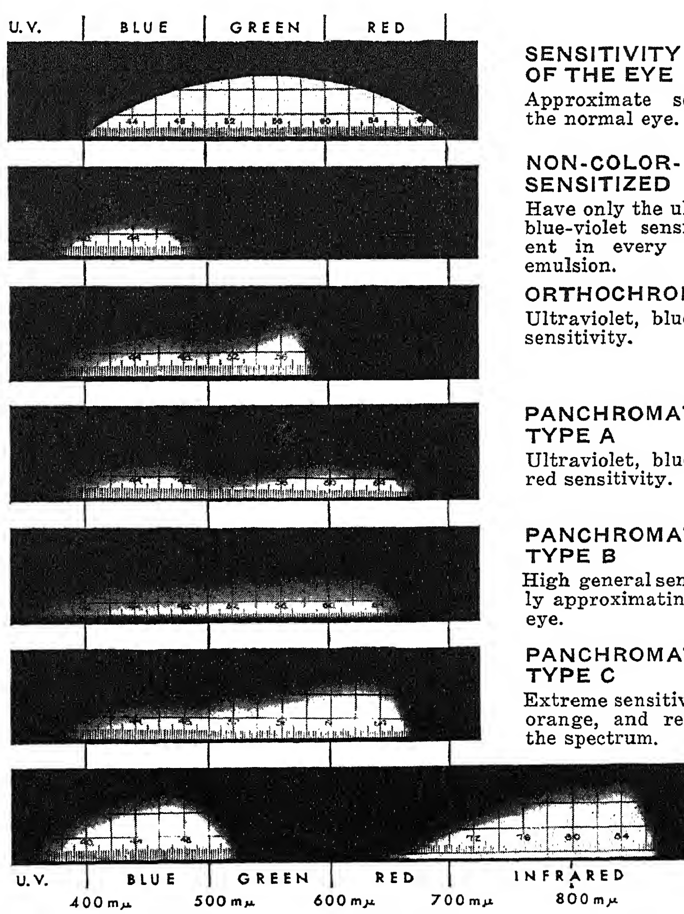
wave length numbers is located immediately in front of the film, so the light forming the spectrum itself shadows these numbers on the film. The film, when developed, shows at once what part of the spectrum affected it. By slightly modifying the form of the spectrograph, more information can be obtained. In addition to indicating that the film *is* sensitive to various colors, it also indicates *how* sensitive it is. This is done by altering the instrument so that the spectrum is very bright at one edge of all the colors and fades out toward the other edge or top. As a result, the top of the image on the film is curved and is highest at the place in the spectrum where the film is most sensitive. Therefore, when spectrograms are made by light similar in color to sunlight, the blue end (400-500 mμ) of the spectrogram is high. But, when spectrograms are made to unfiltered tungsten light, which is very rich in red, the red end (600-700 mμ) of the spectrogram of some panchromatic materials is higher than the blue end. The spectrograms in Figure 6 are obtained by tungsten light of fairly high efficiency. Spectograms of the type shown here do not show as much sensitivity at and below 400 mμ as the film actually has. This is because of limitations in the instrument which have been unavoidable up to the present time. These images are known as wedge spectrograms, or merely as spectrograms, or spectra.



5. This drawing shows how the Spectrograph can be used for the purpose of measuring and showing color sensitivity. It analyzes white light into a spectrum as shown in Figure 1. The film to be tested is placed where the spectrum is formed.

Films and the Spectrum

Films differ from our eyes in the way they respond to the spectrum and, consequently, in the lightness or darkness with which they render various colors. Our eyes respond to red, still more to green, and much less to blue. All commercial emulsions, films, plates, and papers are most sensitive to a region in the blue-violet, near the blue end. Orthochromatic films respond to green, fairly strongly to blue, and strongly to ultraviolet, which we cannot see at all. Panchromatic films respond to the same colors as our eyes, but not to the same extent. They also respond to ultraviolet. Panchromatic films of Kodak manufacture differ in their relative response to colors; the types are called Types A, B, and C. The differences are shown in the spectrograms, Figure 6. Our only excuse for mentioning this is that these types call for different amounts of exposure increase when filters are used.



SENSITIVITY OF THE EYE
Approximate sensitivity of the normal eye.

NON-COLOR-SENSITIZED
Have only the ultraviolet and blue-violet sensitivity inherent in every silver halide emulsion.

ORTHOCHROMATIC
Ultraviolet, blue, and green sensitivity.

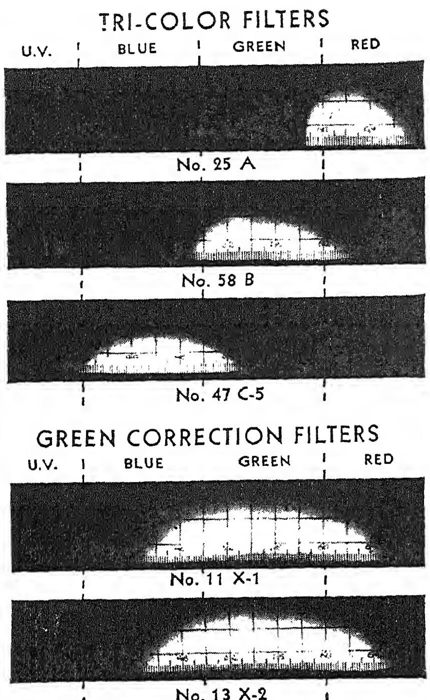
PANCHROMATIC TYPE A
Ultraviolet, blue, green and red sensitivity.

PANCHROMATIC TYPE B
High general sensitivity closely approximating that of the eye.

PANCHROMATIC TYPE C
Extreme sensitivity in yellow, orange, and red regions of the spectrum.

INFRA-RED
Sensitive to blue-violet and invisible infrared region.

6. Spectrograms showing color sensitivity of Kodak film sensitizing types to tungsten light.



7. Spectrograms of several representative filters.

Exposure Increase for Filters

Since filters cut out part of the light, more exposure must be given. This amount of increase, or filter factor, is not the same for all film types, and it also differs between daylight and tungsten light. It is obvious, for example, that the filter factor for the red filter should not be the same for a film whose red sensitivity is a large percentage of its total, as compared with a film whose red sensitivity is a smaller percentage.

A practical way to apply filter factor for outdoor subjects is by adjusting the diaphragm. Most outdoor subjects for which you are justified in using a filter normally call for a small aperture. For this reason, we have prepared for you a little table, which you might like to copy and stick on your camera somewhere, under your camera, or inside the carrying case (pages 66 and 67).

The Kodak Outdoor Filter Guide is a handy gadget for outdoor filter use. It suggests filters for various subjects and includes a dial calculator to save wear on your mathematical machinery.

Meanings of the Terms "Absorb," "Transmit," and "Reflect"

The optical meanings attached to these impressive words are explained thus: When light passes through something, such as a filter, part goes through completely, and part disappears. The part of the light which disappears is *absorbed*, the other is *transmitted.* Thus, a blue filter might *transmit* four-fifths of the blue light falling on it and *absorb* one-fifth; it might *transmit* one-third of the red light and *absorb* the other two-thirds.

Some light also comes back from the surfaces of objects, or is *reflected.* We see objects around us because they reflect light. Very little light is reflected from black surfaces, but nearly all the light on opaque white surfaces, such as blotting paper or chalk, is *reflected.* A colored surface appears colored because it reflects light of the color which we see and absorbs other colors. So, a bright red card in sunlight reflects most of the red falling on it, absorbs most of the blue and green, and does not transmit any.

The Various Applications of Filters

Color filters for black-and-white photography are designed for several different purposes and may be classified as:

1. Correction or orthochromatic filters which are used to alter the response of the film so that all colors are recorded at the brightness values seen by the eye. (The term "orthochromatic" used here means true color rendering and should not be confused with "orthochromatic" film which is sensitive to blue and green but not red.)
2. Contrast filters which distort the brightness values so that two colors having about the same brightness to the eye will have decidedly different brightnesses in the picture. The latter effect is sometimes called "color separation."
3. Haze cutting filters which reduce or eliminate the effects of aerial haze.
4. Tricolor filters for making three-color separation negatives in color printing work.

Filters for Correction

While panchromatic films respond to all the colors which the eye can see, they will not of themselves reproduce the tones of blue, green, and red objects in the same relative values as the eye sees them. For instance, blue and violet appear darker to the eye than green, yet a film is very sensitive to them and will record them as lighter than what they actually are. By the proper use of filters, however, the response of a film can be changed to reproduce colors in the relative brightnesses that the eye sees. The excess ultraviolet and blue-violet sensitivity common to every emulsion requires some absorption of such rays, while the added red sensitivity of some panchromatic materials demands some absorption of red light as well. Filters reducing the amount of light in the blue region of the spectrum without appreciably reducing light of other colors appear yellow and are the most useful photographic filters. The K2, Kodak Color Filter, and G filters absorb the ultraviolet completely, while the K1 absorbs only part of it. All stop the blue to some extent. Those filters absorbing some of the red rays in addition to the ultraviolet and blue are the X1 and X2 light green filters.

It is well to note here that photographic lenses themselves absorb all the ultraviolet rays shorter in wave length than 330 to 350 mμ, depending on the type and thickness of the glass used.

When and which correction filter should you use? Practically all pictures which include sky are improved, and many highly colored subjects are rendered more satisfactorily. The

sky and cloud rendering with all orthochromatic and panchromatic materials is improved by the K2 filter. *This K2 filter serves as the standard landscape filter.*

If for some special reason, you require precisely correct color rendering, use the following:

K2 filter with Type B panchromatic materials in daylight.
X1 filter with Type B panchromatic materials in tungsten light.

X1 filter with Type C panchromatic materials in daylight.
X2 filter with Type C panchromatic materials in tungsten light.

The difference between types B and C panchromatic materials is shown in Figure 6.

In dealing with filters, the terms "undercorrect" and "overcorrect" are frequently and loosely used. Undercorrect usually means that the rendering resembles that from non-color-sensitized films—blues too light; greens, yellows, and reds too dark. Overcorrect usually signifies the reverse—blues too dark; greens, yellows, and reds too light. Both these terms generally are applied to some one color, rather than all colors.

Filters for Contrast Effects

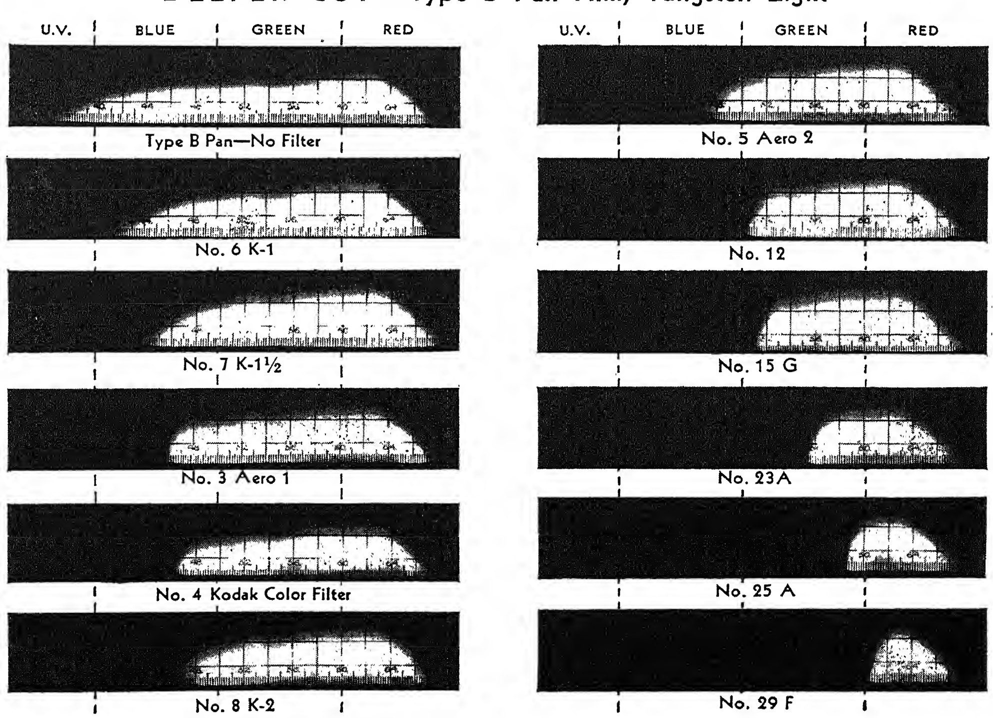
Like truth in some other human endeavors, truth in photography is not always desirable. A correct rendering of a subject having a number of equally bright colors would be flat and uninteresting, so let's have contrast instead.

To the eye, objects are distinguished from their surroundings by contrast which may be of two kinds. It may be a tone contrast or a color contrast. Tone contrast can always be correctly reproduced photographically, but the result of the reproduction of a color contrast very definitely depends on the photographic method used.

The selection of the proper contrast filter for multicolored subjects demands considerable judgment and frequently trial of several filters and films. This is discussed at great length in the Eastman Kodak Company's book *Photography of Colored Objects.* No single rule may be applied to the photography of subjects which exhibit a number of colors. The problem may be approached as follows: If possible, a decision should be made as to which colors should be darkened and which ones lightened to give the desired effect. The color renderings on the Wratten Filter Guide then may be consulted, and one or more filters chosen for trial. The subject may also be viewed through the Eastman Filter Test Chart, and the film and filter used as indicated by the appearance of the subject through the contrast filters.

It will be a saving of time to make several exposures with different filters which may apply. If the results indicate the need for some further modification, comparison of the gray scale renderings of the color patches on the Wratten Filter Guide may offer a suggestion as to further filter choice.

SPECTROGRAMS THROUGH FILTERS OF INCREASINGLY DEEPER CUT—Type B Pan Film, Tungsten Light



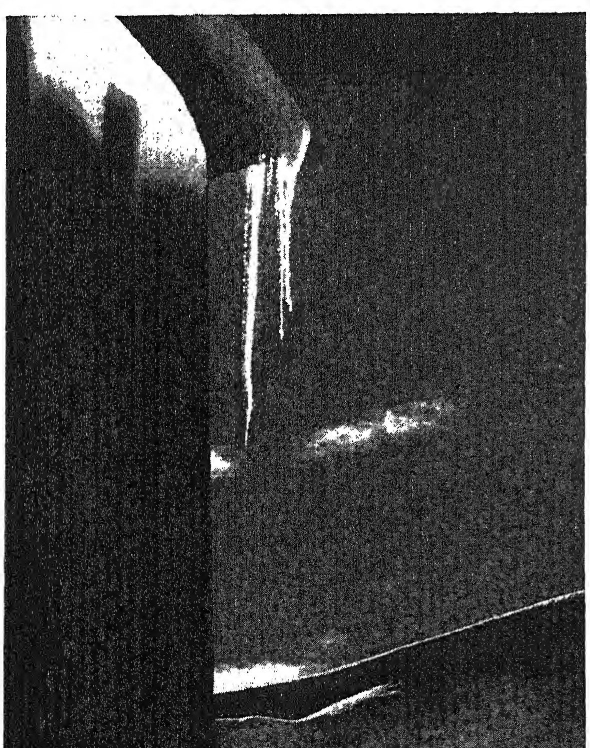
8. Spectrograms made through filters of increasingly deeper cut as shown. See text for additional information.

A useful guide is obtained by applying the following rules for producing color contrast or separation:

To photograph a colored subject as dark, photograph through a filter which absorbs the color of the subject. Very little light reflected from this object will then reach the film and as a consequence, the subject will be reproduced as though it were dark.

Consider the application of this principle to photographing blueprints. The blue parts should be made as dark as possible compared with the white lines. As a red filter absorbs blue light, the best contrast will be produced on panchromatic film with the Wratten A or F Filter. A green filter would do as well if the blue of the blueprint were a very pure color, but it reflects some green light, and therefore the contrast would not be as high with the green filter.

To photograph a colored subject as light, photograph through a filter which transmits the color of the subject. As an example consider photographing a document which is yellow. A yellow filter transmits this color freely, and therefore panchromatic film used with a G filter reproduces this paper as white.



9. ICICLE. Exposure 1/75, f:16, K1 filter, Fast Pan film, 4 x 5 Speed Graphic. Willis T. Geisman photo.

To produce the best detail within a colored subject, photograph that subject as light. For example, the grain detail in polished wood is often of different brightnesses of the same color — let us say yellow. A yellow filter and panchromatic film produce the most prominent grain in photographs of such wood.

The filters by means of which some of the more common colors may be reproduced as lighter or darker are listed below.

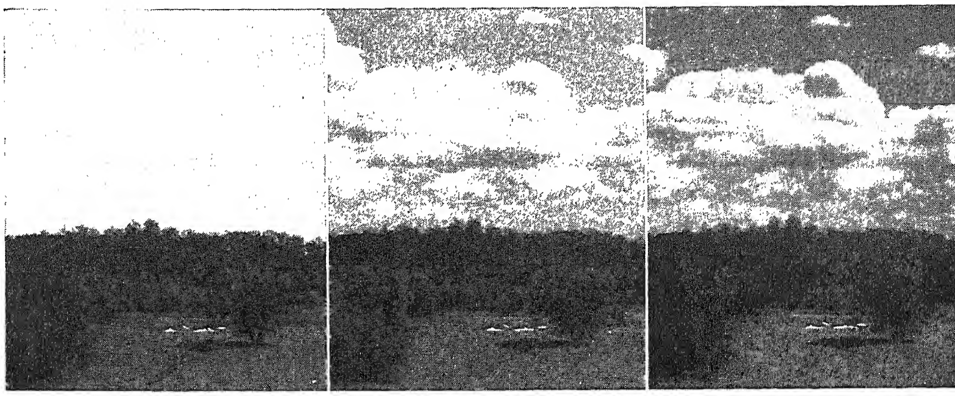
Color of Subject	*Lighter*	*Darker*
Red	F, A or G	C-5 or B
Green	B, G, X-1 or X-2	C-5 or A
Blue	C-5	F, A, G or B
Blue-Green	C-5 or B	F or A
Magenta, Pink	F or A	B
Purple	C-5	B
Yellow	G or A	C-5
Orange	G or A	C-5

It is not possible to add these effects by using two filters together. For instance, reds and blues cannot both be made light by employing the A and C-5 filters together, for if they were combined, the A, absorbing all colors but red, would stop green and blue light while the C-5, absorbing all but blue, would stop red and green. The result would be that practically no light whatever would be transmitted.

Light or Dark Sky

One of the most frequent uses of correction and contrast filters is to darken a blue sky to make white clouds stand out more prominently or to lend emphasis to the subject seen against the sky. In black-and-white photography, yellow or red filters are used for this purpose and these depend for their efficacy upon the blueness of the sky. In some cases, the sky is not reproduced as dark as might be expected, under which conditions any one of the following factors may be responsible:

1. A misty sky does not photograph as dark as a clear sky. An overcast sky is darkened very little by filter application.
2. The sky is frequently almost white at the horizon and shades to more intense blue at the zenith. Therefore, the filter effect at the horizon is small and becomes increasingly greater as the camera is aimed upwards.
3. The sky near the sun is brighter, and less blue than elsewhere and is, therefore, less affected by the use of a filter.
4. The exposure has some influence on the result. Slight underexposure of the negative or dark printing appears to darken further a sky already rendered slightly dark by the use of a filter. Overexposure of the film results in a lighter sky, and the filter effect may appear to be lost.
5. The contrast between the sky and the subject in the final print naturally depends on the lightness or darkness of the subject. With panchromatic film, the sky may be rendered dark in contrast to a light-colored subject, such as white blossoms or snow covered trees, even when no filter is used.



10. Negatives made on a Type C Panchromatic material. Clouds are rendered correctly with the K-2 filter and spectacularly with the A filter.

No Filter K-2 (yellow) Filter A (red) Filter

6. The depth of filter (whether yellow or red) and the film used affect the rendering of the sky. A blue sky is increasingly darkened by the following film and filter combinations.

Negative Material	*Filter*	*Monochromatic rendering of a Clear Blue Sky*
Non-Color-Sensitized	None	Lighter than correct
Orthochromatic	None	Lighter than correct
Panchromatic	None	Lighter than correct
Orthochromatic	K-2	Practically correct
Panchromatic	K-2	Practically correct
Panchromatic	G	Darker than correct
Panchromatic	A	Very dark
Panchromatic	F	Almost black
Infrared Sensitive	A	Black

Another filter for darkening the sky, and one which has advantages under certain conditions is the Kodak Sky Filter. This is a divided filter, the top half being light yellow, the bottom half clear, and the whole cemented between "B" glass. The design permits filtering the sky without affecting the foreground and, as a consequence, no increase in exposure is necessary. This makes the filter especially valuable when Kodak Regular N.C. or Verichrome Film is used.

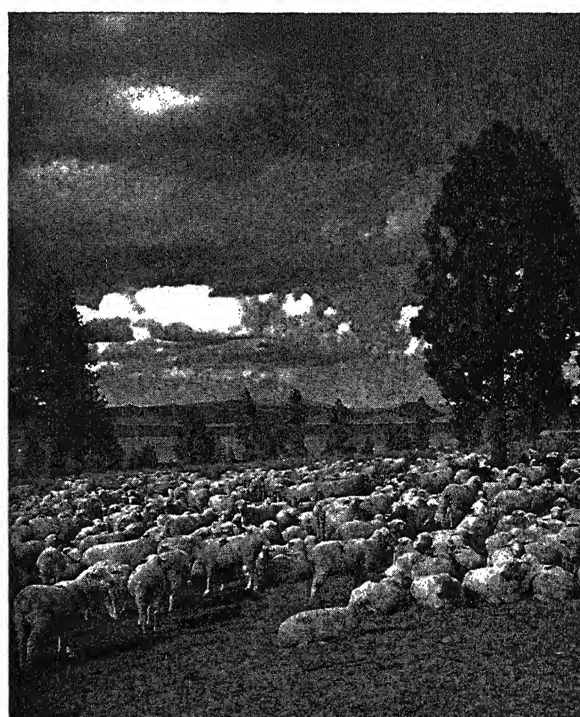
The Kodak Sky Filter owes its effectiveness to its natural separation from the lens diaphragm and to the small diaphragm openings required for sunlit landscapes (see Fig. 12).

Another method of darkening the sky is by means of the Kodak Pola-Screen. This is advantageous in black-and-white photography when the use of a yellow or red filter noticeably distorts the color rendering of the foreground subject. Moreover, the Pola-Screen offers the only known means of darkening a blue sky with Kodachrome Film. The Pola-Screen has its greatest effect on that band of the sky which is at right angles to the rays of the sun.

Filters for Penetrating Haze

Distant landscapes and aerial views from high altitudes appear veiled by bluish haze, even on clear days. When photographed without a filter, this veiling hides some of the detail visible in the original scene. The contrast of distant detail is degraded because the haze between the scene and the camera causes a second uniform exposure to be added to the image of the distant detail itself. True atmospheric haze is bluish and is caused by light being scattered by very small particles of dust and water vapor and to some extent by the air itself. The blue color of the sky is principally due to scattering of the molecules of the air.

Atmospheric haze should not be confused with mist or fog, both of which are white, and are composed of water droplets. True atmospheric haze scatters very little red light, some green light, more blue light, and a large amount of ultraviolet, which in photography is



11. **HERDED SHEEP.** 1/40, f:11, K1 filter. 4 x 5 Speed Graphic. Copyrighted photo by Willis T. Geisman.

more important than the visible haze. Since all photographic materials are highly sensitive to violet and ultraviolet, unfiltered pictures of distant landscapes record more haze than is visible. But if the photograph is taken by light of longer wave length (green, red, etc.), the amount of recorded haze decreases. Thus the amount of recorded haze decreases steadily in the order of the list given under "Filters for Darkening the Sky."

Filters for Color Separation Negatives

Matched sets of red, green, and blue filters are used for making three-color separation negatives for color printing. The standard filters commonly used are:

Red	No. 25	(A)
Green	No. 58	(B)
Blue	No. 47	(C-5)

For some special tricolor reproduction work, for example in making Eastman Wash-Off Relief Color prints from color transparencies, the following three "narrow cut" filters may sometimes be used with advantage in place of the regular tricolor set.

Red	No. 29	(F)
Green	No. 61	(N)
Blue	No. 49	(C-4)

Filters for Infra-Red Photography

The sensitivity of Eastman Infra-Red Safety Film, Eastman Infra-Red Sensitive Plates and Kodak Infra-Red Film is shown in Figure 6. It should be noted that these materials are sensitive not only in the extreme red and the infra-red region of the spectrum but also in the blue region. With infra-red sensitive materials, therefore, it is necessary to use a filter which absorbs the blue and sometimes the visible red light in order to allow the picture to be made entirely by infra-red radiation.

For many purposes, any filter which completely absorbs the blue end of the spectrum, such as the Wratten No. 15, No. 25, or No. 29, will be entirely satisfactory. However, all these filters transmit light of the extreme red end of the spectrum to which the emulsion is sensitive (Fig. 8), so that the picture is made partly by infra-red and partly by visible red. If the picture is to be made entirely by infra-red, a visually opaque filter such as the Wratten No. 70, No. 89, or No. 87 filter should be used. The latter filters require about double the exposure necessary with the lighter ones mentioned above.

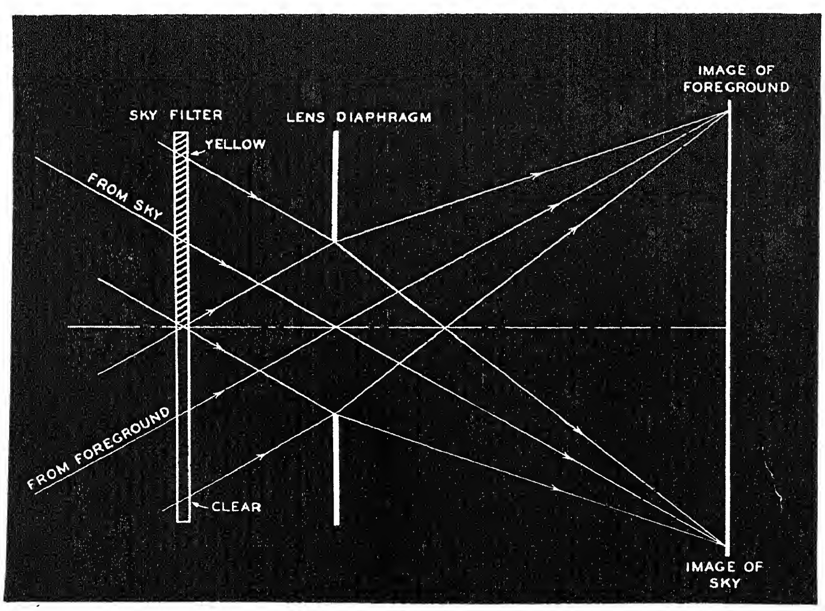
The Eastman Infra-Red Process Plate is not sensitive to the extreme visible red so that any filter which absorbs the blue end of the spectrum is adequate to insure that the picture will be made entirely by infra-red. Furthermore, all of the exposures required with the different filters will be the same, provided they absorb no infra-red radiation.

The Purpose of Individual Filters

While over 100 Wratten filters are available for scientific and photographic work, practically all photographic effects may be obtained by a small number of them. The most useful of these and their purposes are described below.

THE WRATTEN SKY FILTER. The upper half is yellow (equivalent to a Wratten K1½) and the lower half is clear. This filter darkens the sky to render clouds in a pleasing manner and to yield other desirable sky background effects. No extra exposure is required. This filter is intended for use with Kodak Verichrome and other orthochromatic films.

THE WRATTEN COMMERCIAL FILTER SET. The set consists of the following filters: K1, K2, X1, G, A, F, B, and C5. The purpose of each of these filters is described as follows:



12. Diagram showing the working principle of the sky filter. Note how the upper half of the filter is used to give better sky correction while the foreground portion is unobstructed.

THE WRATTEN K1 FILTER (Wratten No. 6) is a very light yellow in color and affords partial correction. That is, it darkens the sky and shows up clouds, but not so much as the K2 filter does. Red and yellow subjects, such as flowers, are rendered lighter than with no filter, but not so light as with the K2 filter. The K1 filter is useful when some correction is desired, and a short exposure is necessary. It can be used with both panchromatic and orthochromatic materials.

THE WRATTEN K2 FILTER (Wratten No. 8) is a yellow filter which, when used in daylight with Type B panchromatic materials, such as all Kodak Panatomic-X Films and Eastman Safety Portrait Panchromatic A. H. Film, renders the brightness of colored objects as the eye sees them. Such rendering is desirable in all such subjects as:

Distant views	Yachting scenes	Sunsets
Landscapes	Marine views	Clouds
Beach scenes	Mountains	Snow scenes

In addition, the K2 filter is valuable in much outdoor commercial work, such as architecture, and in the studio when a light rendering of red and yellow subjects is required, but not so light a rendering as the G filter gives. The K2 filter can be used with both panchromatic and orthochromatic materials.

THE WRATTEN X1 FILTER (Wratten No. 11) is a light green correction filter for daylight use with Type C panchromatic materials such as Kodak Super XX rolls and packs, Eastman Tri-X, and Eastman Safety Super Sensitive Films A. H. The need for this filter with these materials arises when bright yellows, reds, and greens are present, as in flowers. This film-and-filter combination also produces a desirable effect in making a close-up of a face against the sky, in which case the use of a yellow filter results in a chalky rendering of the face.

The X1 filter is also a correction filter for Type B materials in tungsten light. Should the rendering of the first result on such materials as Eastman Portrait Panchromatic Film, taken without a filter, need improvement, the X1 filter should be tried before any of the contrast filters unless the need is indicated definitely for the latter.

THE WRATTEN X2 FILTER (Wratten No. 13) (not one of the regular commercial set) is a darker green correction filter intended for full correction with type C panchromatic materials in tungsten light (Photoflood Lamps or high efficiency incandescent lamps.) The same rules apply for use as outlined above for the X1 filter under tungsten light. The X2 filter is not intended for daylight use.

THE WRATTEN G FILTER (Wratten No. 15) is a deep yellow contrast filter intended for use with panchromatic materials. Its high filter factor excludes its ordinary use with orthochromatic films such as Kodak Verichrome Film. The G filter has four principal outdoor uses:

1. It renders yellow and red objects lighter than the eye sees them.

2. It penetrates distant haze to a greater extent than the eye (a valuable property in taking pictures of distant mountains and also in aerial photography). Because of the effect on haze, all distant scenes taken with telephoto or other long-focus, still-camera lenses are improved by the G filter and are improved further by deeper filters if exposure times permit. Telephoto pictures taken without filters tend to lack contrast.

3. It renders a blue sky darker than is correct in order to emphasize the foreground subject — a building, for example. In a similar way, in marine scenes, the G filter darkens the water surface. The bluer the water appears, the more pronounced is the effect. Thus, subjects on the water may be rendered light in contrast to the water.

4. It produces an enhanced rendering of texture in outdoor subjects photographed under a blue sky. The small cast shadows which reveal texture are illuminated by bluish light from the sky, whereas the high-lighted portions receive the yellowish sunlight; such shadows are, therefore, deepened by any filter which absorbs blue light. The G filter, therefore, enhances the texture in such subjects as architectural stone, sand, fabrics, and so on, when they are photographed in sunshine under a blue sky.

In the studio, the G filter has two general uses: producing *contrast* between the blue parts and the yellow, brown, orange, or red parts of a subject, and producing *detail* in any yellow, brown, or orange subject. Showing grain in yellow and brown wooden furniture is an example of this.

The G filter can be used also in photography with Eastman Infra-Red Sensitive Plates.

THE WRATTEN A FILTER (Wratten No. 25) is another contrast filter which is confined to use with panchromatic materials. Its applications outdoors are similar to those of the G filter, but the effects are more pronounced. As compared with the G filter, the A filter renders red and yellow subjects lighter, blue subjects darker, and enhances the texture of outdoor subjects. More haze penetration is secured; hence, the A filter is used in both long-distance ground photographs and aerial photographs whenever the required exposure time permits. The dark rendering of blue skies by the A filter is helpful in producing spectacular photographs of buildings and similar subjects. Slight underexposure in some cases produces moonlight effects. It also renders spectacular sunsets, for the red and yellow parts are produced brightly against blue sky and gray clouds.

In the studio, the A filter is most useful in producing contrast — for example, in photographing a blueprint to show the lines light against a dark background. The A filter renders blues and greens as dark, and yellow, orange, and red as very light. This filter is valuable also in producing detail in brown or red subjects, such as mahogany furniture.

It is the standard red filter for making tricolor separation negatives for color printing.

The A filter also is normally used with Eastman Infra-Red Sensitive Plates. The exposure time for such materials is the same whether the G, the A, or the F filter is used.

THE WRATTEN F FILTER (Wratten No. 29) is also a contrast filter, a deeper red than the A filter. Therefore, the effects with the F filter are more pronounced than with the A filter. Its higher filter factor more or less confines its use to studio application with panchromatic materials, preferably Type C materials. The difference in rendering between the A and F filters is most noticeable in the rendering of greens and blue-green. The F filter renders such colors darker, although there are unusual exceptions to this. Light blue subjects, such as blue typewriting, are rendered very dark. Slightly greater contrast in photographing blueprints is secured with this filter than with the A filter.

The F filter is useful along with the C-4 (No. 49) and the N (No. 61) filters in making separation negatives from Kodachrome originals.

It also can be used in infra-red photography.

THE WRATTEN B FILTER (Wratten No. 58) is most useful as a tricolor filter; it is the standard green filter for separation negatives. As a contrast filter it is useful in rendering green subjects lighter than blue and red ones. Interesting photographs of trees against the sky have been made with the B filter.

THE WRATTEN C5 FILTER (Wratten No. 47) is the standard blue filter for separation negatives, but it serves as a contrast filter when blue subjects are to be rendered as light as possible. Results with the C5 filter and panchromatic film are very similar to those obtained on ordinary (non-color-sensitized) film with no filter. For this reason, the C5 filter enhances any aerial haze present, which adds "atmospheric quality" to pictorial landscape pictures.

THE AERO 1 FILTER (Wratten No. 3). This is a yellow filter similar to the K1 but which cuts out more blue light. It was originally introduced for haze cutting in aerial photographs taken at low altitudes. Now it is found quite useful in daylight when less correction than that obtainable with the K2 filter is needed for effect.

THE AERO 2 FILTER (Wratten No. 5). This is another yellow filter, deeper than the Aero 1, but not so deep as the G filter. It was also originally introduced for haze cutting, but at higher altitudes where more haze intervenes between aeroplane and ground, and where longer exposure times are possible. The newer panchromatic materials permit short aerial exposures with much deeper filters than the Aero 2. The deeper filters increase haze penetration. Like the Aero 1, the Aero 2 filter has found favor for ground use. It is used for stronger effects (that is, darker skies, lighter reds and yellows, etc.) than are obtainable with the Aero 1.

THE KODACHROME FILTERS (Wratten Nos. 1, 2A, and 85B) are dealt with fully in the chapter on Kodachrome Photography.

How to Choose Filters for General Outdoor Subjects

In the accompanying table are a number of subjects commonly encountered in outdoor photography and filters suggested for each. Where the K-2, G, or C-5 filter is indicated, Verichrome may be used in addition to any of the panchromatic films, but where the X-1, A, or F filter is listed, one of the panchromatic films, such as Panatomic-X, Super-XX, or Tri-X must be used. Due to the impurity of colors occurring in nature, it is not always easy to tell just what filter will accomplish the desired result. Blue objects, for example, may also reflect a great deal of green light which, due to the predominance of blue, is not apparent to the eye. Where there is some doubt as to the proper choice of filter, it is wise to repeat the picture for each filter indicated and to select the best result afterwards. In many cases the variations will be small but may make the final difference between a beautiful picture and a mere record.

SELECTION OF FILTERS FOR OUTDOOR USE

Subject	*Effect Desired*	*Suggested Filter*
Clouds against Blue Sky or Blue Sky as Background for Other Subjects	Natural	K-2
	Darkened	G
	Spectacular	A
	Almost Black	F
	Night Effect	A plus Pola-Screen, A or F with Infrared Material
Marine Scenes when Sky is Blue	Natural	K-2
	Water Dark	G
Sunsets	Natural	None or K-2
	Increased Brilliance	G or A
Distant Landscapes	Addition of Haze for Atmospheric Effects	C-5
	Very Slight Addition of Haze	No Filter
	Natural	K-2
	Haze Reduction	G
	Greater Haze Reduction	A or F
	Haze Elimination	A or F with Infrared Material
Nearby Foliage	Natural	K-2 or X-1
	Light	B, or G with Verichrome Film
Outdoor Portraits Against Sky	Natural	X-1, K-2, or Pola-Screen
Flowers		
Blossoms and Foliage	Natural	K-2 or X-1
Red, "Bronze," Orange and Similar Colors	Lighter to Show Detail	A
Dark Blue, Purple and Similar Colors	Lighter to Show Detail	None or C-5
"Foliage" Plants	Lighter to Show Detail	B, or G with Verichrome Film

Architectural Stone, Wood, Fabrics, Sand, Snow, etc., when Sunlit and Under Blue Sky	Natural	K-2
	Enhanced Texture Rendering	G or A

Simple Exposure Table for Outdoor Filter Shots
Average Subjects in Sunlight

Filter	*Lens At*	*Shutter*
None	f/16	Panatomic-X at 1/25 second or Super-XX or Tri-X at 1/100 second
K1	f/16 — f/11	
K2	f/11	
Pola-Screen	f/11	
X1	f/8 — f/5.6	
G	f/11 — f/8	
A	f/8 — f/6.3	

Aids in the Use of Filters

Wratten Filter Guide: This card shows the gray scale rendering of six color patches for the X-1, K-2, G, A, B, C-5, and F filters for both sunlight and Photoflood light.

Kodak Outdoor Filter Guide: This pocket sized guide shows the most suitable filter for various outdoor subjects and includes a calculator for obtaining the exposure for several types of films and for various filters.

Contrast Viewing Kodaguide: The guide contains gelatin filters through which the subject can be viewed in order to determine the film and filter for best rendering of the subject.

Filter Carrying Cases: Carrying cases are available for certain of the Combination Lens Attachments. These cases hold an adapter ring, a filter retaining ring, a lens hood, a Pola-Screen, and six cemented filter disks.

References

For further information, see the following references.

PHOTOGRAPHY OF COLORED OBJECTS
WRATTEN LIGHT FILTERS
PHOTOGRAPHY BY POLARIZED LIGHT

These are published by The Eastman Kodak Co., Rochester, N. Y., and are for sale at your photographic dealers.

Kodak Combination Lens Attachments

These are designed to provide a universal set of lens attachments. They cover the lens size range from ¾ to 2½ inches in 1/16-inch intervals by means of four main attachment sizes, known as Series V, VI, VII, and VIII, plus a large number of Adapter Rings.

Attachments available in this system are:

1. Any Wratten Filter in "B" glass, unmounted, and of the proper diameter, placed in the Adapter Ring and held in place by the Insert Ring which comes with the Adapter Ring.
2. The Kodachrome Filters, used like any Wratten Filters. (Use of these filters fully described in the chapter on Kodachrome Photography.)
3. The Kodak Pola-Screen Type IA, which may be used alone, in combination with any filter, or with another Pola-Screen.
4. The Kodak Lens Hood, which fits any of the other attachments.
5. The Step-Up Ring permits lens attachments of one series to be used with an adapter ring of a smaller size, thus one set of filters, etc., can be used on two lenses differing considerably in size.

Advantages of this System

1. One series of attachments, plus the proper Adapter Rings, can serve a number of lenses within the range of this series.
2. The attachments may be used in any combination.
3. The design simplifies the problem of fitting lenses of any diameter or type by making special Adapter Rings, which can be done by any good machinist.

13. Negatives made on a Type C Panchromatic material. Control of bluish haze by filters. C5 adds aerial perspective; K2 and G show increasing penetration.

Above, K2 filter; below, no filter.

Above, G filter, below, C-5 filter.

DATA ON KODAK COMBINATION LENS ATTACHMENTS

	Series V (Inches)	*Series VI (Inches)*	*Series VII (Inches)*	*Series VIII (Inches)*
Outside diameter of lens-mount	¾ - 1 3/16	1¼ - 1 21/32	1 11/16 - 2	2 1/16 - 2½
Thread outside diameter (all are "V" threads, 36 per inch)	1.319	1.752	2.146	2.638
Wratten Filter diameter	1 3/16	1⅝	2	2½
Clear diameter of Pola-Screen	1 5/32	1 19/32	1 15/16	2 7/16
Outside diameter of Lens Hood	2 1/16	Ser. VI 2 5/16 †Ser. VIA 1 31/32	2¾	3¼

Sizes of Adapter Rings	V In.	V Mm.	VI In.	VI Mm.	VII In.	VII Mm.	VIII In.	VIII Mm.
	¾	19	1¼	31.5	1 11/16	42.5	2 1/16	52
	13/16	20.5	1 5/16	33	1¾	44.5	2⅛	54
	⅞	22	1⅜	35	1 13/16	46	2 3/16	55.5
	15/16	23.5	1 13/32	35.5	1⅞	47.5	2¼	57
	1	25.5	1 7/16	36.5	1 15/16	49	2 5/16	58.5
	1 1/32	26	1 15/32	37	2	50.5	2⅜	60
	1 1/16	27	1½	38			2 7/16	62
	1⅛	28.5	1 9/16	39.5			2½	63.5
	1 3/16	30	1⅝	31				
	* ¾	19	1 21/32	42				
	*1	25.5						
	* 55/64	21.7						

Kodak Pola-Screen Viewer fits indicator handle of Type IA Pola-Screen (any series).

* Screw-in type filters: ¾ in. for Leica Elmar 5 cm lens; 1 in. for Zeiss Super Nettel with Tessar f:3.5 lens; 55/64 for Kodak Retina I.

† Required for Kodak Bantam Special and Kodak Retina II. Fits Series VI attachments.

CLASSIFICATION OF EASTMAN SENSITIVE MATERIALS

For Assignment of Filter Factors

Films: *Sheet Films*	*Rolls and Packs*	*35mm and Bantam*	Eastman and Wratten Photographic Plates
NON-COLOR-SENSITIZED Commercial Commercial Matte Process AH		Safety Positive H.C. Safety Pos.	NON-COLOR-SENSITIZED Eastman 40, Eastman Universal Eastman 33, Eastman Process Eastman Contrast Process AH Eastman Lantern Slides Soft, Medium, Contrast AH
ORTHOCHROMATIC Ortho-X AH Super Ortho-Press AH Super Speed Ortho, Portrait AH Par Speed Portrait Commercial Ortho AH, Contrast Process Ortho AH	Verichrome Super Ortho-Press		ORTHOCHROMATIC Eastman Ortho-Press AH Eastman 50, Eastman S. C. Ortho Eastman Polychrome, Eastman Post Card Eastman D. C. Ortho, Eastman Commercial Wratten Metallographic AH
PANCHROMATIC TYPE A Commercial Pan			
PANCHROMATIC TYPE B Super-XX Pan AH Portrait Pan AH Panatomic-X AH Contrast Process Pan AH	Panatomic-X Plus-X	Panatomic-X Plus-X Super-XX Micro-File	PANCHROMATIC TYPE B Wratten Tricolor Pan AH Kodak Panatomic-X AH, Wratten Pan Wratten Process Pan AH Wratten "M" AH, Wratten C. T. C. Pan AH
PANCHROMATIC TYPE C Tri-X Pan AH Super Panchro-Press AH Panchro-Press AH Super Sensitive Pan AH, Kodatron Pan AH	Super-XX Super-XX Cirkut	Direct Positive Pan	PANCHROMATIC TYJE C Eastman Super Panchro-Press AH
INFRARED-SENSITIVE Infrared Sheet Film			INFRARED SENSITIVE Eastman Infra-Red Process AH Eastman Infra-Red Sensitive

FILTER FACTORS FOR KODAK FILMS AND PLATES

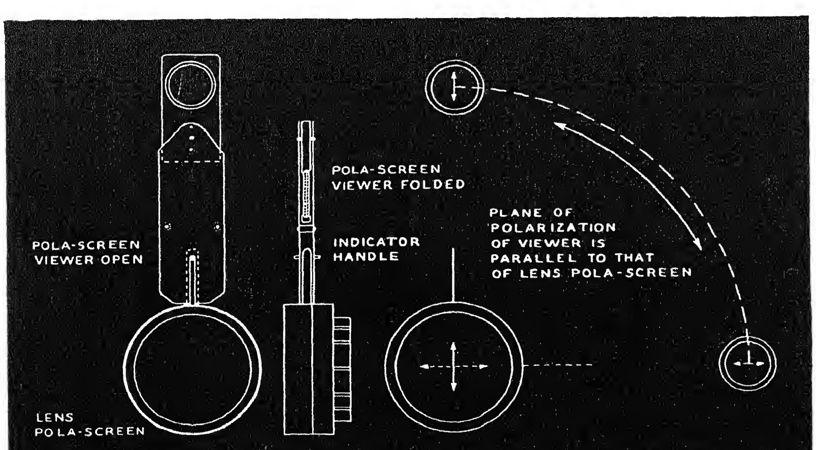
Filter		*Non-Color-Sens.*		*Ortho-chromatic*		*Pan A*		*Pan B*		*Pan C*		*Filter*
	No.	*Day.*	*Tung.*	*Day.*	*Tung.*	*Day.*	*Tung.*	*Day.*	*Tung.*	*Day.*	*Tung.*	
Kodak Color	4	8	5	2	1.5	2	1.5	1.5	1.5	1.5	1.5	Kodak Color
K-1	6	4	3	2	1.5	2	1.5	1.5	1.5	1.5	1.5	K-1
K-1½	7	8	5	2	1.5	2	1.5	1.5	1.5	1.5	1.5	K-1½
K-2	8	12	9	2.5	2	2.5	2	2	1.5	2	1.5	K-2
K-3	9	20	15	2.5	2	2.5	2	2	1.5	2	1.5	K-3
Minus Blue	12	......	......	3	2.5	3	2.5	2	1.5	2	1.5	Minus Blue
G	15	......	......	5	3	4.5	3	3	2	2.5	2	G
B	58	......	......	8	4.5	12	9	6	6	7	6	B
A	25	......	......	......	......	8	4	7	4	4	2	A
C-4	49	6	6	9	12	10	15	12	24	12	24	C-4
C-5	47	2.5	2.5	3	3.5	3	5	5	10	5	10	C-5
E	23	......	......	......	......	7	3.5	5	3.5	3.5	2	E
F	29	......	......	......	......	12	5	15	8	8	4	F
L	50	......	......	......	......	20	30	24	40	24	40	L
N	61	......	......	......	......	14	10	7	7	9	8	N
X-1	11	......	......	......	......	......	......	4	3	5	4	X-1
X-2	13	......	......	......	......	......	......	......	......	......	5	X-2
Aero 1	3	4	3	2	1.5	2	......	1.5	......	1.5	......	Aero 1
Aero 2	5	18	14	2.5	2	2.5	......	2	......	2	......	Aero 2
Pola-Screen I	......	......	......	6	4	4	3	4	3	4	3	Pola-Screen I
Pola-Screen IA	......	......	......	2.5	2.5	2	2	2	2	2	2	Pola-Screen IA

Kodak Pola-Screens

How the Pola-Screen Works

Ordinary unpolarized light vibrates in all planes perpendicular to the direction of its propagation; polarized light, in only one plane, as shown in Figure 15. The Kodak Pola-Screen is in effect an optical slit which transmits only light vibrating in the plane of that slit. The intensity of light already polarized can be controlled by rotation of a Pola-Screen in its path. The beam is entirely cut off when its vibration plane and that of the Pola-Screen are "crossed," and wholly transmitted when these vibration planes are parallel.

There are two common sources of polarized light in nature. (1) Light reflected from nonmetallic surfaces, such as wood, glass, water, paint, etc., at approximately 32° is polarized. The effect is less at other angles and disappears entirely at 0° and 90°. (2) Light from a clear, blue sky at right angles to the sun is strongly polarized; at other angles polarization is less complete and vanishes at 0° and 180° from the sun.



14. The Kodak Pola-Screen Viewer.

Sky and Reflection Control with Pola-Screens at Lens

Kodak Pola-Screens are available as units of the Kodak Combination Lens Attachments, which are described on the accompanying pages. These fit lenses ¾ inch to 2¼ inches in diameter. Pola-Screens, 2½, 3½, and 4½ inches in diameter for larger lenses, as shown in Figure 16, and a suitable holder are provided also.

Since the smaller Pola-Screens, for use with lenses 2½ inches and smaller, are used frequently with cameras in which the image cannot be seen on a ground glass, the angular adjustment of the Pola-Screen is simplified by the use of the Pola-Screen Viewer.

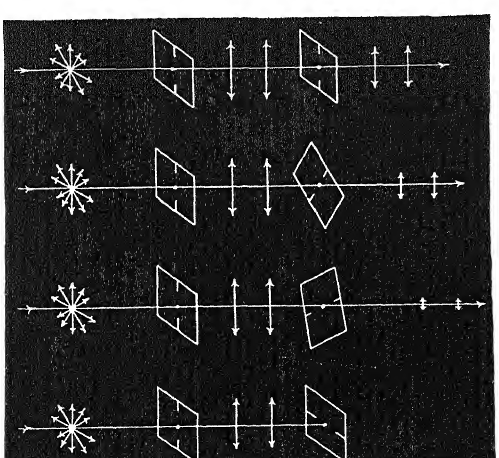
Copying and Reflection Control with Pola-Screens at Lenses and Lights

An even more extensive control of reflection can be obtained in the studio by using Pola-Screens over illuminating lamps as well as over the camera lens. For use at the lamp, a large Pola-Screen, Type IIB, in a 12-inch square with suitable holder and stand is available. By this means the subject being photographed can be illuminated with polarized light. This extensive reflection control applies to surfaces which are not necessarily oblique to the camera axis. Such reflections can be subdued to almost any degree, or they can be increased slightly if desired.

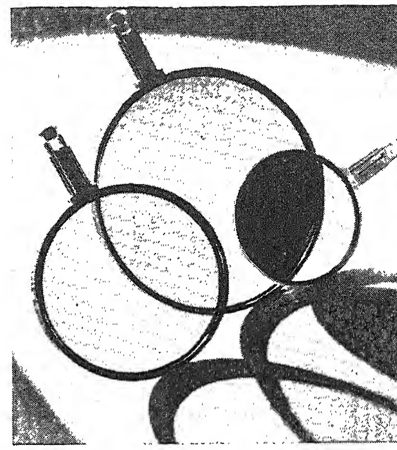
The specific applications of Pola-Screens at both lens and lights are:

1. For copying rough prints, matte prints, damaged prints, and oil paintings which show strong reflections due to cracks, canvas texture, or brush marks.
2. For copying any subject with the lights undiffused and quite close to the camera.
3. For subduing the reflections in many studio subjects, whether or not these reflections are oblique.
4. For creating unusual lighting and background effects.

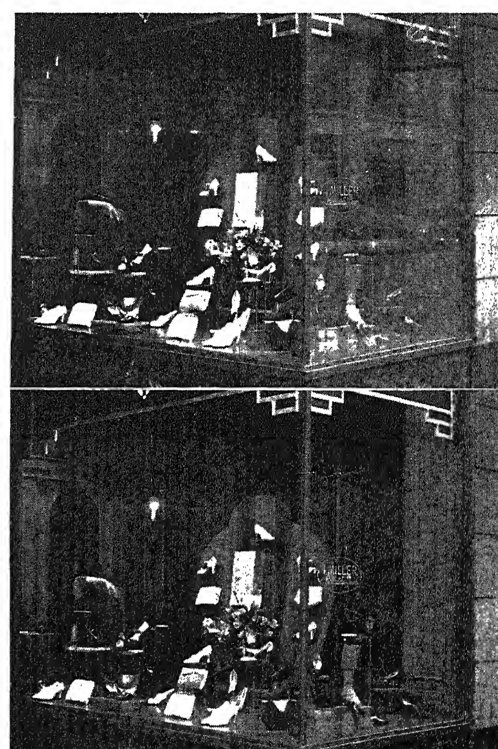
Further details of the principles and use of Pola-Screens may be found in the Eastman publication, "Photography by Polarized Light."



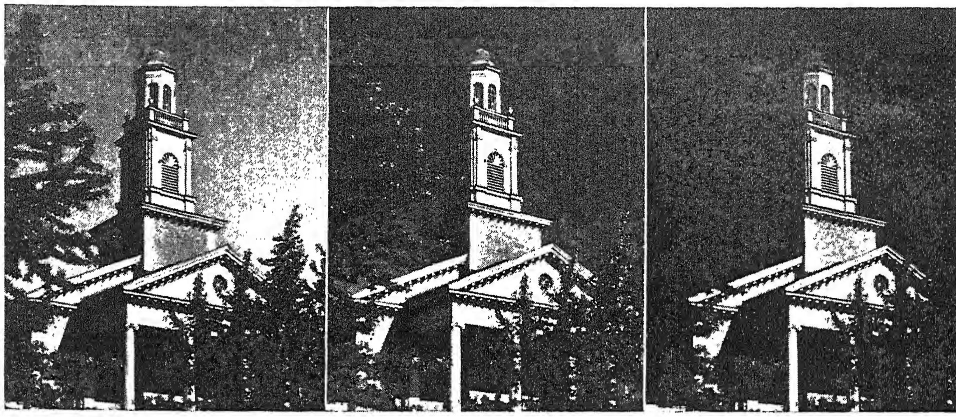
15. Effect of rotation of one Pola-Screen relative to another. The amount of light let through by the second Pola-Screen is cut down as the Pola-Screen is turned. When the vibration plane of the second Pola-Screen is at right angles to the first, practically no light gets through.



16. This actual photograph helps to illustrate the line drawing shown in Figure 15. Note how the light coming from the rear is completely blocked out when the Pola-Screen is rotated to a 90 degree position.



17. There are many applications for the use of Pola-Screens. The above illustrations show the results when a Pola-Screen is used for photographing a glassed-in window display. Note how the reflection on the glass is completely eliminated with the use of the Pola-Screen over the camera lens.



No filter | Pola-Screen | Pola-Screen and "A" filter

18. Negatives made on a Type C Panchromatic material. Controlling sky brightness over a wide range is possible with the Pola-Screen when photographing at right angles to the sun's rays. Night effects are obtained with the Pola-Screen and "A" filter together.

Details—Kodak Pola-Screen

Color: Neutral gray. Transmits plane polarized light of all visible colors. Absorbs ultraviolet rays.

Sensitive Materials: Can be used with all sensitive materials including Kodachrome.

Uses: *Darkening the Sky in Black-and-White Photographs.* A blue sky can be darkened to about the same extent as with an A filter without distorting the color rendering of the foreground. The greatest effect occurs when the indicator handle points toward the sun, when photographing at about right angles to the sun.

Dark Blue Sky Effects in Kodachrome: Pola-Screens offer the only known means of sky brightness control in color photography. Such subjects as blossoms, spring and autumn foliage, buildings, etc., are rendered in a very spectacular manner when photographed against a sky so darkened.

Photographing Through Glass or Water: When the camera axis is about 35° from the surface, reflections through glass or water are subdued to show detail beyond or below by locating the Pola-Screen in the required position.

Subduing Oblique Reflections to Show Texture: Reflections from lights or light backgrounds can be subdued to show texture in nonmetallic subjects such as grained wood, linoleum, tile, brightly printed and lacquered subjects, fabrics, leather, etc. As before, the most effective camera angle is about 35° to the surface. The Pola-Screen at the lens alone will not subdue reflections from metal surfaces.

Reflection Control in Copying: The Pola-Screen at the lens alone has *no* application to copying but when Type IIB Pola-Screens are also placed at the lights a very complete control is offered over reflections from copy or some other studio subjects.

Exposure Factors:* Pola-Screen Type IA over lens alone:

	Daylight and Tungsten
All orthochromatic materials	2.5
All panchromatic materials	2
All Kodachrome Film	2

*The factors as given are sufficient for average subjects. Fifty percent more exposure may be necessary in some cases.

Available Sizes: Type IA — All series for Kodak Combination Lens Attachments. In W-mount for Ciné-Kodak f/1.9, 1-inch lenses.

SUMMARY OF PROPERTIES AND USES OF WRATTEN FILTERS

Filter	*Color*	*Main Uses*	*Contrast Effects* — *Colors Made Lighter*	*Contrast Effects* — *Colors Made Darker*
Sky	Half yellow	Sky correction for ortho film; no exposure increase		
K1	Light yellow	Slight correction, daylight	Others	Blues
K2	Yellow	Correction, good skies, general use, daylight	Others	Blues
Aero 1	Light yellow	Slight haze cutting	Others	Blues
Aero 2	Yellow	Same haze penetration as eye	Others	Blues

(continued on top of next page)

(continued from page 71)

Filter	*Color*	*Main Uses*	*Lighter*	*Darker*
G	Deep yellow	Dark skies, cloud effects, haze cutting, contrast effects	Greens Yellows Reds	Blues
X1	Light green	Correction in flowers, etc. Type C Pan film, daylight	Greens Yellows	Blues Reds
X2	Medium green	Correction in studio subjects, Type C Pan film	Greens Yellows	Blues Reds
A	Red	Very dark skies, greater haze cutting, contrast effects, Infra-Red, tricolor separation negatives	Yellows Reds	Blues Greens
F	Deep red	Almost black skies, greater haze cutting, contrast effects	Yellows Reds	Blues Greens
B	Green	Contrast effects, tricolor separation negatives	Greens Yellows	Blues Reds
C5	Blue	Contrast effects tricolor separation negatives	Blues	Greens Reds Yellows

Filter Sizes for Popular Graflex, and Speed Graphic Lenses

The Series and Adapter Ring size are given here for the Kodak Combination Lens Attachments. An Adapter Ring and either, 1) a Filter Retaining Ring or, 2) a Lens Hood is required. Lenses greater than 2½ inches in their barrel diameter cannot be fitted with filters of this type, but require filters in individual cells of the proper size.

	Series	*Lens Barrel Diameter (Adapter Ring Size) Inches*	*MM*
National Graflex			
Bausch & Lomb Tessar f/3.5, 75 mm.	Special filter mounts		
Series B Graflex—Revolving Back 2¼ x 3¼, 3¼ x 4¼ and 4 x 5			
Kodak Anastigmat f/4.5, 5-1/2 in.	VI	1-9/16	39.5
" " " , 6-3/8 in.	VII	1-3/4	44.5
" " " , 7-1/2 in.	VII	2	50.5
Series B Graflex—Stationary Back 5 x 7			
Kodak Anastigmat f/4.5, 8-1/2 in.	VIII	2-3/8	60.0
Series D Graflex—Revolving Back 3¼ x 4¼ and 4 x 5			
Kodak Anastigmat f/4.5, 6-3/8 in.	VII	1-3/4	44.5
" " " , 7-1/2 in.	VII	2	50.5
Bausch & Lomb Tessar f/4.5, 6-3/8 in.	VII	1-3/4	44.5
" " " " , 7-1/2 in.	VII	2	50.5
Cooke Aviar f/4.5, 6 in.	VII	1-13/16	46.
" " " , 7 in.	VII	2	50.5
Goerz Dogmar f/4.5, 6-1.2 in.	VII	1-15/16	49.
" " " , 7-1/2 in.	VIII	2-7/16	62.

	Series	Lens Barrel Diameter (Adapter Ring Size) Inches	MM
Schneider Xenar f/4.5, 6-1/2 in.	VII	1-7/8	47.5
" " " , 7-5/8 in.	VIII	2-1/4	57.
Carl Zeiss Tessar f/4.5, 6 in.	VI	1-21/32	42.
" " " " , 7 in.	VIII	2-1/16	51.
Cooke Pressic f/3.5, 6-1/4 in.	VIII	2-3/8	60.
" " " , 7-1/2 in.		2-13/16	71.5
Schneider Xenar f/3.5, 7-1/16 in.	VIII	2-1/4	57.
" " " , 8-1/4 in.		2-3/4	70.
Carl Zeiss Tessar f/3.5, 6-1/2 in.	VIII	2-3/8	60.
" " " " , 8-1/4 in.		2-3/4	70.
Cooke Anastigmat f/2.9, 6-3/8 in.		2-5/8	66.5
Plaubel Anticomar f/2.9, 6 in.	VIII	2-5/16	58.5
" " " , 7 in.		2-3/4	70.
Auto Graflex—Revolving Back 3¼ x 4¼ and 4 x 5			
Kodak Anastigmat f/4.5, 7-1/2 in.	VII	2	50.5
" " " , 10 in.		2-5/8	66.5
Bausch & Lomb Tessar f/4.5, 7-1/2 in.	VII	2	50.5
" " " " , 9-3/4 in.		2-5/8	66.5
Cooke Aviar f/4.5, 8-1/4 in.	VIII	2-3/8	60.
" " " , 10 in.		2-5/8	66.5
Goerz Dogmar f/4.5, 7-1/2 in.	VIII	2-7/16	62.
" " " , 9-1/2 in.		2-3/4	70.
Schneider Xenar f/4.5, 8-1/4 in.	VIII	2-1/4	57.
" " " , 9-7/16 in.		2-3/4	70.
Carl Zeiss Tessar f/4.5, 7 in.	VII	2	51
" " " " , 10 in.		2-3/4	70.
Cooke Pressic f/3.5, 7-1/2 in.		2-13/16	71.5
Home Portrait Graflex—Revolving Back 5 x 7			
Kodak Anastigmat f/4.5, 10 in.		2-5/8	68.
" " " , 12 in.		3-3/8	85.5
Miniature Speed Graphic 2¼ x 3¼			
Kodak Anastigmat f/4.5, 4-1/8 in.	VI	1-1/4	31.5
" " " , 5 in. (127 mm)	VI	1-5/16	33.
Bausch & Lomb Tessar f/4.5, 4-3/8 in.	VI	1-5/16	33.
Schneider Xenar f/4.5, 4-3/4 in.	VI	1-1/4	32.
Kodak Ektar f/3.7, 4-1/8 in. (105 mm)	VI	1-1/2	38.
Kodak Ektar f/4.5, 4 in. (101 mm)	VI	1-1/4	31.5 or 32.

(continued on page 74)

	Series	Lens Barrel Diameter (Adapter Ring Size) Inches	MM
Speed Graphic $3\frac{1}{4}$ x $4\frac{1}{4}$, 4 x 5 and 5 x 7			
Kodak Ektar f/4.7, 5 in. (127 mm)	VI	1-1/2	38.
Kodak Anastigmat f/4.5, 5 in. (in shutter)	VI	1-5/16	33.
Kodak Anastigmat f/7.7, 8 in.	VI	1-5/16	33.
Kodak Anastigmat f/4.5, 5-1/2 in. (in shutter)	VII	1-3/4	44.5
" " " , 5-1/2 in. (in barrel)	VI	1-9/16	39.5
" " " , 6-3/8 in. (in shutter)	VII	1-3/4	44.5
" " " , 6-3/8 in. (in barrel)	VII	1-3/4	44.5
" " " , 7-1/2 in. {in shutter, in barrel}	VII	2	50.5
" " " , 8-1/2 in. {in shutter, in barrel}	VIII	2-3/8	60.
Bausch & Lomb Tessar f/4.5, 5-1/4 in. {in shutter}	VI	1-3/4	44.5
" " " " , 6-3/8 in. {in shutter, in barrel}	VII	1-3/4	44.5
Cooke Aviar f/4.5, 6 in. {in shutter, in barrel}	VII	1-13/16	46.0
Goerz Dogmar f/4.5, 5 in. {in shutter, in barrel}	VI	1-7/16	37.
" " " , 6-1/2 in. {in shutter, in barrel}	VII	1-15/16	49.
Hugo Meyer Primotar f/4.5, 5-1/4 in. {in shutter, in barrel}	VI	1-21/32	42.
Ross Xpres f/4.5, 6 in. {in shutter, in barrel}	VI	1-21/32	42.
Schneider Xenar f/4.5, 5-5/16 in. {in shutter, in barrel}	VI	1-21/32	42.
Voigtlander Heliar f/4.5, 5-1/4 in. {in shutter, in barrel}	VI	1-21/32	42.
Carl Zeiss Tessar f/4.5, 5-1/4 in. {in shutter, in barrel}	VI	1-21/32	42.
" " " " , 6 in. {in shutter, in barrel}	VI	1-21/32	42.
Cooke Pressic f/3.5, 6-1/2 in. (in barrel)	VIII	2-3/8	60.
Schneider Xenar f/3.5, 5-7/8 in. {in shutter, in barrel}	VII	1-7/8	47.5
" " " , 6-1/2 in. {in shutter, in barrel}	VIII	2-1/4	57.
Carl Zeiss Tessar f/3.5, 5-1/4 in. {in shutter, in barrel}	VIII	2-1/16	51.
" " " " , 6 in. {in shutter, in barrel}	VIII	2-1/16	51.
Cooke Anastigmat f/2.9, 6-3/8 in. (in barrel)		2-5/8	66.5
Plaubel Anticomar f/2.9, 6 in. (in barrel)	VIII	2-5/16	58.
" " " , 7 in. (in barrel)		2-3/4	70.
Wide Angle Lenses			
Schneider Angulon f/6.8, 3-9/16 in. {in shutter, in barrel}	VI	1-1/4	32.
" " " , 4-3/4 in. {in shutter, in barrel}	VI	1-21/32	42.
Goerz Super Dagor f/8, 4-3/8 in. {in shutter, in barrel}	VI	1-1/4	31.5
Zeiss Wide Angle Dagor f/9, 3 in. {in shutter, in barrel}	V	1	24.
" " " " " , 4 in. {in shutter, in barrel}	VI	1-5/16	32.
Bausch & Lomb, Protar V. f/18, 3-1/2 in. (in barrel)	VI	1-5/16	32.

*

A DESIGN FOR PRINTING

ANSEL ADAMS

Photographic procedure is based on three prime elements . . . Visualization, the Negative, and the Print. Prior to the operation of the shutter the final print should be well in mind—the approximate composition, and the tonal relationships. The procedure of production is therefore conceived "backward": from the print to the act of exposure;—the print paper and developer used, the degree of development of the negative, and the required exposure—all should be considered **before** the photograph is made. Interrelation of the technical and the aesthetic through every step of the process is absolutely essential to superior results.

Lacking creative visualization, a photograph, no matter how perfect in the mechanical sense it may be, can be never more than a superficial record of physical reality. Visualization does not imply, except in extreme instances, a detailed point-for-point **pre-creation** of the print in the mind of the photographer. True visualization relates to the generalities—composition and arrangement, quality of definition, size and proportion, tonal values, print "color," and the subtle mood derived from all the basic qualities combined in relation to the subject and its significances. In other words, the final print is "felt" rather than "seen" with mechanical accuracy.

This implies a procedure:

First, of recognizing a subject of photographic and expressive significance.

Second, of visualizing the completed photograph, technically and aesthetically.

Third, of exposing and developing the negative in relation to the requirements of the print.

Fourth, of making the print.

Fifth, of presenting the print (mounting, framing, etc.)

All the elements of procedure should be in resonance; each must be considered in relation to the other. At times the process of visualization may be exacting and tedious—again, it may be immediate and intuitive. In fact, as experience grows, visualization becomes more and more intuitive, the creative response to subject material more acute, and the results more intense and expressive.

The student soon learns that his visualization of the completed photograph must be in terms of the print itself and within the limitations of the photographic medium. Subject-perception is not enough, nor is it permissible to think in terms of other graphic media . . . painting, etching, lithography, etc. Unfortunately, photographic production of today is still concerned largely with "pictorial" strivings for effects other than those gained through a straightforward application of photographic thinking and technique. Thoughts and feelings, negatives and prints are manipulated all too often under the false impression that "art" requires "manner," and that the criteria of romantic-literal 19th century painting are the Alpha and Omega of all expression. The camera, properly used, is no more a mechanical "tool" than the painter's brush or the etcher's knife, and the emotional-aesthetic elements are derived from the imagination, taste and technique of the artist no matter what form of expression is involved. We do not speak or write in two languages at the same time, nor do we paint with oil and water-colors on the same canvas. What justification have we then for superimposing the technique and expressive values of painting or etching on a photographic image? The photographic expression and technique achieves its most profound impact when it is simple, direct, and entirely true to itself.

In the operative sense, photographic technique is simple. Those workers who are striving for complex techniques are usually compensating for barren creative imaginations. Study of the monumental work of Stieglitz, Strand, and Weston will reveal the power and effectiveness of a simple technical approach to photography. These men use the simplest possible equipment and materials; their message "comes through" with the convincing impact of great art. They have explored practically every phase of photographic method; as their experience grew their work became simpler and richer. Count the huge number of photographic papers and printing processes on the market; then recall that Azo and Convira—ordinary "photo-finishing" papers—are entirely satisfactory to convey the greatest photographs of our time. Some of Stieglitz's finest prints are on Azo . . . Weston's superb recent work is printed on Convira

and Velox. The same holds true of the projection prints of our best contemporaries—wonderful results have been obtained from such "commercial" papers as Brovira, Velour Black and Kodabromide. In the clean-cut world of straight, honest photography there is little place for the fussy trick papers, texture screens, and manipulative processes that merely serve to obscure the photographic message and depreciate photography as a most important form of expression.

Basic Photographic Values

In interpretative photography the print is conceived as an emotional transcription of the subject and not as a mere literal symbol of reality. In fact, no photograph can literally "look like" the subject; no negative can record **all** the values of the subject, and no print can faithfully render **all** values of the negative. The photograph is **something in itself** as well as a transcription of reality. Instead of thinking of photography as a limited means of portraying reality, we should think of it as a means of exceeding the limitations of reality . . . but only in terms of the medium itself. This statement is considered by some workers as a defensive rule established by the photographic purists for their own protection. Such is not the case; there are many logical and aesthetic reasons why the integrity of **any** medium of expression should be inflexibly preserved. Accordingly, the serious "straight" photographer uses all the peculiar qualities of his medium to the utmost, transcribing reality in terms of photographic values, exaggerating or minimizing as he sees fit, creating an image in black, white, and gray that conveys a symbolic impact of the subject in terms of **subject-medium-artist.** The production of the print is the concern of the photographer; the final print of a fine photograph concerns both the photographer and the spectator.

The purpose of this article is to stimulate thought about an approach to straight printing and projection in terms of expressive photography. There is little need to go into details of mechanical properties of different papers, the constitution and properties of myriad developers, and the strictly technical facts of procedure. The manufacturers have covered all this for us with a completeness and accuracy far beyond the capacities of the average creative photographer. We are primarily concerned with proper usage of the excellent materials at our command. Technically we will do well to follow the advice of the manufacturers for their particular products; expressively, we must find our own way, and select the materials best suited for our purposes. We cannot violate any basic physical or chemical laws and "get away with it," but we can **adapt** details of procedure to our personal advantage and in relation to what we want to express through our prints.

The purely technical-realistic approach to photography would indicate that the best possible photograph would be one in which the intensities of the subject were most accurately represented in the values of the print. Such a photograph would require, in addition to perfection of the optical image, that the full scale of the negative material be utilized—that exposure and development be precisely "correct." It would also require that the full scale of the negative material be reflected in the scale of the print—that all values in the print be as close as possible to the values of the subject. We might even carry the "illusion" further; we could select a paper surface that suggested the texture of the dominant subject, and we could also tone the print to imitate more accurately the tone and color of the subject. Granted that we could do all this and create an astonishing illusion of our subject . . . what would we gain? The results would teach us a good lesson . . . that nature—external reality — cannot be imitated. The three-dimensional world is never going to be re-created on a two-dimensional surface (stereoscopic photography notwithstanding.) No matter how astonishing the mechanical and technical accomplishment, the **essence** of the subject can never be presented in literal terms. What the photograph can do is something vastly more important than mere imitation; it can perpetuate a moment of time . . . symbolize form, texture, tonal values . . . create an emotional symbol of reality. It can carry our perceptions far beyond the superficial physical aspects of the world. **Art,** says Wilensky, **is the enlargement of experience,** and Photography, as an art, is no exception to this definition. The so-called "perfect negative" and "perfect print" are therefore without meaning. Each is "perfect" only insofar as it serves to convey the visualization of the photographer.

In theory, there is no difference between a contact print and an enlargement: both are positives from respective negatives. In actuality, however, certain very real differences exist. A contact print preserves the maximum detail and delineation of the negative, and slow contact papers admit considerable variations and adaptations of print-exposure and development, strength of printing light, etc. An enlargement requires a paper of greater "speed," which is usually of less "latitude" in tonal scale. It also requires that the optical image of the negative be sufficiently accurate to admit magnification, and that the negative have a minimum of mechanical defects.

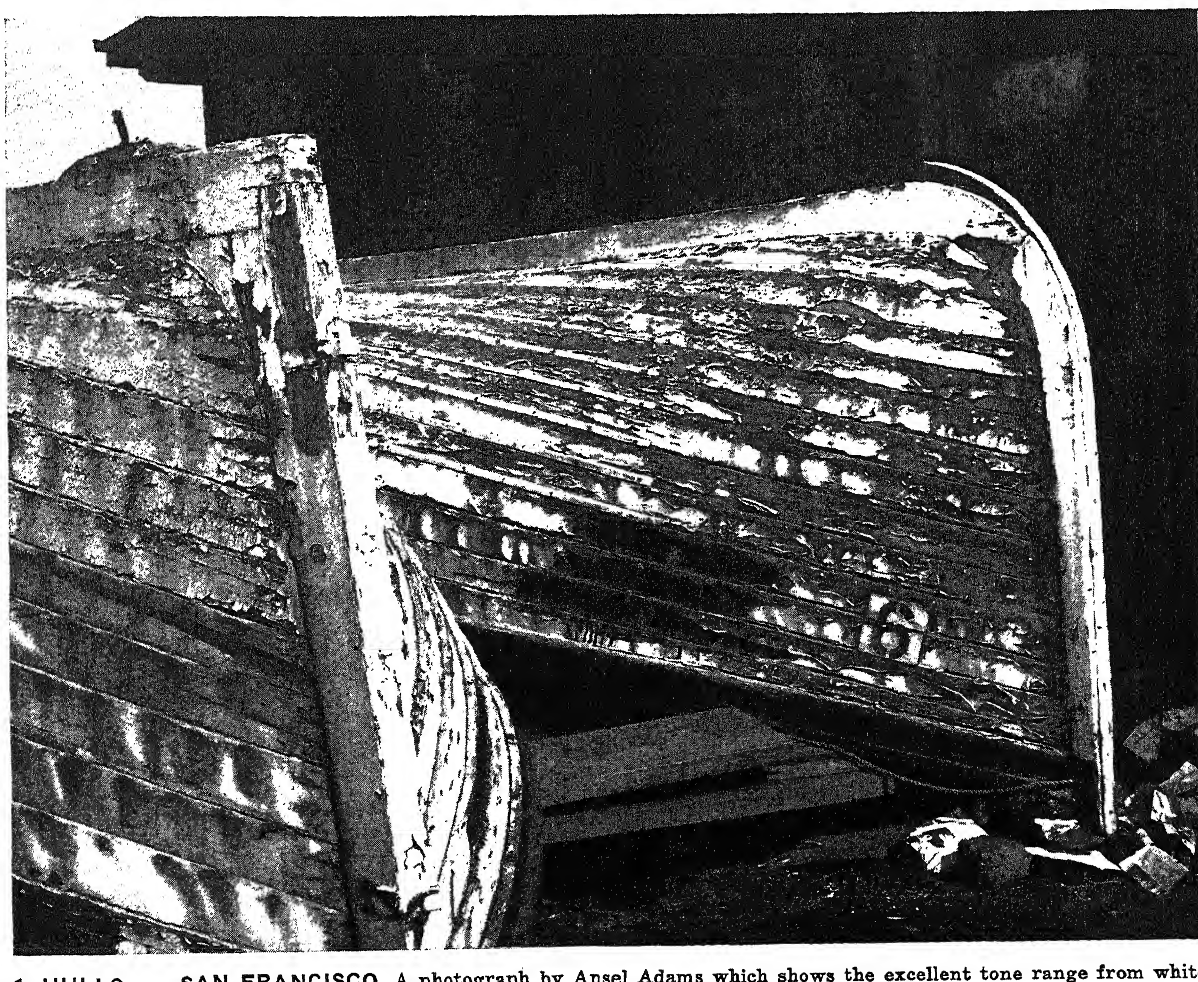
What Is The Best Picture Size?

At this point it will be well to consider the factor of image-size. A certain composition may be very effective in 4 x 5-inch size, and quite unsatisfactory in 8 x 10-inch size . . . purely on an emotional basis. Likewise, a picture conceived in 8 x 10-inch size may suffer considerably if reduced to 4 x 5-inch size. The advantage of composing the picture on the ground-glass of the camera and making a contact print from the re-

sulting negative is quite obvious. Yet, if one thinks of the final print size, when negatives are made with small cameras, the logical compositional results will be superior. This is an important point that few workers ever think about. "Enlargement" in most people's minds is limited only by the clarity and quality of the negative image. Composition, texture, size and form of subject, and distance of viewing the enlargement are all factors that are of supreme importance. Stieglitz has a marvelous photograph of a cobweb and grass with dew, the print of which is about 2½ x 3½ inches in size. Probably it could be enlarged to 11 x 14 and keep excellent definition, but the actual size of the print, small as it is, conveys the delicacy and mood of the subject as a larger print from the same negative could not accomplish. Photographers as a group are "salon minded," making prints too large and too consistently of the same size regardless of the more subtle inherent qualities of the subject and its treatment.

Tonal Scale and Print Color

Considering tonal scale, we do well to start with the basic idea that there must be no blank white or solid black as part of our tonal palette, although we can occasionally use small areas of these extremes as **accents.** To put the matter in another way . . . we should always have some indication of detail (form and substance) in our darkest shadows, and some indication of detail and tone in our whitest whites. Complete blacks and blank whites must be the exception . . . not within the full working scale of tones. A photograph that contains the entire range of tones, plus pure black and white, may be compared to a musical composition that includes all the audible sounds and a few harmonics which give "color" to the principal sounds. When the subject requires that the full range of tones be used, well and good . . . the print will be rather spectacular and powerful in effect. But we must not forget that the subtle interplay of tones within a narrow band of intensities is often as essential to our expression as the heroics of a complete tonal range. There is nothing more boring than to see an exhibit of prints, all of which have the same range of tone, irrespective of the subject and its implied emotional content.



1. HULLS . . . SAN FRANCISCO. A photograph by Ansel Adams which shows the excellent tone range from white to black . . . in addition to being a well composed picture.

Print color is a very subtle element to consider. The writer is not in favor of obviously toned prints, strong buff papers, and the ordinary sepia tones—to say nothing of blue, green, red, and other colors, which are usually harsh and unpleasant. Let us now examine some of the tones that can be utilized to advantage . . . we will consider the tones of the available papers . . . and the resultant effects of various developers thereon.

White Paper

There is no such thing as a pure white paper. What we call "white paper" may be of several degrees of brilliancy (actually several stages of very light gray), and may be either "warm" (reflecting a bit of yellow, pink, or red), or "cold" (reflecting blue). "Cold" white is synonymous with "blue" white; "warm" white may very faintly suggest cream or pink. Most white photographic papers are of the blue-white type. The normal developing tones are blue-green-black when using Metol-Hydroquinone with most papers, and blue-black when using Amidol with bromide papers. Glycin and modifications of the Metol-Hydroquinone formula yield a variety of tones running into warm brown-black. These tones are very subtle —by no means may they be thought of as colors, and they have no quality of **superimposed tone.**

Cream Paper

Usually termed "Natural White"; the tonal range is about the same as white paper with the same developers, but the blacks are a bit warmer, and the whites assume the tone of the basic paper stock.

Ivory Paper

All tones are accentuated towards the "warm" side. There are few varieties of good ivory paper—most of them are too close to yellow and buff. A true ivory paper would have a delicate cream tinge and a smooth, luminous surface.

Buff Paper

I do not know of one brand of buff paper that is not basically unpleasant in color. Both blacks and whites lose their vigor, and the spectator is conscious of "color," or, at least, of a very strong tone which dominates the image.

The above relates to plain prints without subsequent toning. Ordinary sepia toning—whether by re-development or by the Hypo-Alum process does not, in any case, yield a beautiful tone. An egg-yolk color is produced by these methods, and no matter to what stage the toning is carried, this color is suggested. From a basis of pure color, the yellow-brown of the ordinary photographic sepia tone is very disagreeable to me.

Gold Toning

The only toning process that the writer feels acceptable . . . and then only under certain conditions . . . is "Gold Toning." By this process a cold, purple brown tone is produced which actually increases the brilliancy of the image. A slight application of this toning process will give a subtle increase of brilliancy without apparently changing color; further application makes the print quite luminous, and a change of color is apparent only by comparison with an untoned print. Extended application produces a continuous change of tone towards a warm chocolate, or even to a brick-red in some Chloride papers. Careful use of this toning process will vastly extend the range of brilliancies of most prints. Formulas can be made up, but both the Barstone Gold Toner, and the Agfa Flemish Toner will give excellent results. Chloride and Chloro-bromide papers must be used; this toning process is not recommended for straight Bromide papers. The warmer the paper stock, the warmer the resulting tone of the print (for any given time of toning and for the same emulsion and the same degree of development of the print). Also, a fully developed print "tones" more slowly and "colder" than an under-developed print. It is very hard in this process to match prints in tone.

It is well worth the student's time to investigate the various tone controls—paper stock, developer, and subsequent toning—so that he can produce prints with extended emotional effects related to his particular style and visualization. He should make a series of tests—prints from the same negative on various papers, using various developers, and different stages of toning. The variety of results will be astonishing, and it will be immediately apparent that only a few of the many prints will be satisfying.

Print surface is also of the greatest importance. A fine negative contains extraordinary detail . . . detail beyond the scope of normal vision. And this detail, being a most important element of photographic interpretation, is best recorded in a print of smooth, brilliant surface. Not only is the detail better rendered, but the brilliancies are enhanced if a glossy surface is used, (ferrotyping—high gloss—is not necessary). If a glossy surface cannot be used, the next best choice is a smooth semi-matte-luster surface. A dead matte surface is bad—so is a "textured" surface of any kind. In the dead matte surface the brilliancies of the subject are minimized; in the "textured" surface the fine textural qualities of the image are submerged by the relatively gross textural qualities of the paper-surface. The "textured" surfaced papers are used to a great extent by certain commercial, portrait, and "pictorial" photographers who are attempting to inject an "art" feeling into their work. Still another phase is the use of canvas surfaces, or a texture screen between negative and paper. Many photographers feel that all this is remote from an honest and direct photographic expression, but it is true that there is still a large percentage of "salon" photographs of this general character.

Finally, the presentation of the print must be given careful consideration. Mounting a print is more than firmly affixing it to a piece of cardboard. Surface, texture and color of the board must relate to the qualities of the print, and the size, and proportion of the board, and the placement of the print thereon, have a direct

association with the size, proportion, and composition of the print. There is something to be said for the consistent size of exhibit mounts, but if a print is treated individually so much the better for it. If a standard mount is used, the placing of the prints is consistent, and often the suggestion of vigor and formal balance is lost by this restriction. In both vertical and horizontal subjects only the top and bottom margins may be varied, but the balance between the top and bottom margins can make or break a fluent composition.

Needless to say, technical and mechanical excellence is important throughout; spotting must be done with great care; the treatment of the print throughout the various stages of processing must be such that no breaks or wrinkles appear, and the finished prints should be kept in separate folders and protected with tissue papers.

A final admonition, to which many will agree—when showing prints from portfolio, limit the number to twelve or fifteen. If the prints are rich in content, they deserve time for inspection and contemplation. If every print is grasped to the fullest extent, the spectator cannot possibly "take in" more than a few. To show quantities of prints even to experts assures fatigue or, at least, a very superficial appreciation of the prints as a group. Place prints for inspection in a good light, and be certain to arrange the light at an angle that will not give reflections. Good presentation is a very important element of production; sloppy presentation can injure the effectiveness of the best work.

Now, for the making of a photograph: step by step, from visualization to final print. Of course, no two photographs are conceived and executed alike, but the basic principles exist in all work . . . both contact prints and enlargements. I have selected a typical landscape as an example of an average complex procedure:

Winter . . . Yosemite Valley

I perceive and am interested in the subject matter, especially from the viewpoint here represented. (My interest is not limited to subjects such as this . . . whatever impresses me as potential picture material undergoes close scrutiny.) When this subject was considered as a possible picture my interest in it became more intense and varied.

I am interested in the **brilliance** of the subject . . . the striking contrast between the dark tree trunks and the distant snowy mountain. It is apparent that a good, if conventional, placement of the mountain is inevitable; composition in this case is very simple. But, apart from the extraordinary brilliance of the subject, there are many details of texture and tonal relationships that will tax the capacity of the medium. I mentally note the difficulties, and proceed to . . .

Visualize the final photograph. This I try to do completely . . . even to the mount. This visualization is very accurate in some respects and very broad in others. I see the composition and the general placement precisely as it will be; but I "feel" the mood of brilliance that must pervade the entire picture. I know that I must work for extremes of tone . . . from the gleaming white of the snow to the deep, rich blacks of the shadowed tree trunks. The water must be dark and yet transparent, the bits of snow on the trees, both near and far, must gleam consistently. The sky value must be not too light or too dark, in order that both the snowy mountain and the clouds will be properly revealed.

Once this visualization is reasonably complete, I must consider the negative required. I determine that No. 2 Convira B is the paper best suited for a subject of this type. The negative, accordingly, will be made for that paper. It must be fairly strong, but not harsh. It must have full detail in both whites and blacks, yet the scale should be quite complete. A soft negative could contain the same series of values in shorter compass, which would be extended by the use of a more contrasty paper. But, in that case, it might be very difficult to hold the values of the tonal extremes . . . blacks might become solid and whites block to opacity.

Isopan film will be used, and an exposure, slightly under normal, with an X1 filter (to preserve the greens as much as possible) will be given. I am therefore relying on the "toe" portion of the curve to hold shadow details; I am favoring the extreme brilliance of the snow areas by so doing. However, I know that development must be most carefully conducted, as the range of tones of the subject is more than any negative material under normal conditions can accommodate, and it will be necessary to control densities by development of a specific type, as follows:

Instead of regular development procedure with Pyro, Pyro-Metol, or Metol-Hydroquinone-Borax formulas, I will use straight Pyro with ¾ strength of the carbonate component. This reduction of the carbonate in the formula will favor more transparent highlights. As the problem of full brilliance requires that there be adequate separation between tones in both highlights and shadows—not just separation between whites and darks—I must work for full development of the shadows and middle tones, and, at the same time, prevent over-development of the highlights. The reduction of the carbonate content will help a little, but I will use the "alternate water bath" system for maximum effect. It is carried out as follows: The negative is first desensitized in Pinakryptol, then rinsed, then placed in the developer for about 15 seconds and constantly agitated. It is then placed in a tray of fresh water for about 2 minutes without agitation. With a normal dilution of the developer stock solutions, the image should appear in about 1 minute after immersion in the developer. After two

minutes in the water bath, the film is returned to the developer for about 20 seconds and agitated, then for two minutes more in the water bath without agitation. The regular procedure thereafter will be—40 seconds in the developer, 2 minutes in the water bath; 80 seconds in the developer, 2 minutes in the water bath. This would approximate normal development time.

However, in this particular case, it was necessary, after the 40-second developing period and the following 2 minutes in the water bath, to **shorten** the following times in the developer and prolong the alternate times in the water bath. Instead of ten or twelve minutes total development time, I gave about 24 minutes total. Yet the negative was in the water 20 minutes out of the 24.

The theory of such procedure is that the developer solution penetrates the emulsion and reduces the silver halide at a rate depending on the energy and quantity of the developer. After a given time in the developer the emulsion has absorbed a certain amount of developer and reduction is taking place at all points in the film. Now, take the film out of the developer and place it in a pan of clear still water; there is no replenishment of developer in the emulsion, and the lack of agitation induces what developer there is in the film to stay. This developer keeps on reducing silver until it is used up—but it is obvious that it is used up much faster in the highlights (strong densities of the film) than in the shadows (low densities of the film). Effectually, the shadows and middle tones are developed to a proportionately greater extent than the highlights, tonal separation is assured in the middle and shadow tones, and the highlights are not blocked, as they are relatively underdeveloped.

Merely developing the negative for less than normal time would result in a general flatness; by the time the brilliance was increased through the use of a contrast paper an unpleasant harshness would appear, and the subtle internal value-relationships would be lost.

I followed the above procedure in exposing and developing.

Now . . . the print

The negative being produced according to the requirements of the visualization, I still had a problem in getting just the right print. The first prints made conveyed the proper brilliance as far as actual tonal relationships were concerned. I used a regular Metol-Hydroquinone formula on Convira B 2, but was not pleased with the print "color"; it was a bit dead in relation to the actual snap and brilliance of the image. In other words, the print color did not do justice to the image quality. In order to increase the effective brilliance and improve the color I gave a slight gold-toning to the first print. The result was slightly better, but the tone was a bit too warm. I then made prints on Convira B 2 with Agfa 103 Formula, which yielded a definite blue-black image. This was a great advance in quality, but the print was still too dead and "cold" in color. I then gold-toned the print developed in 103, and achieved an extraordinary quality and "color." The amount of gold-toning was very slight; the slight touch of purple-brown was apparent only by comparison with an untoned print. But the increase in richness and depth of tone exceeded expectations. The print is reproduced herewith, but I doubt that many of the subtle values will be apparent in the reproduction. That is no direct criticism of the engraver of these illustrations; hardly any reproduction process can approach the varied and subtle values of a rich photographic print.

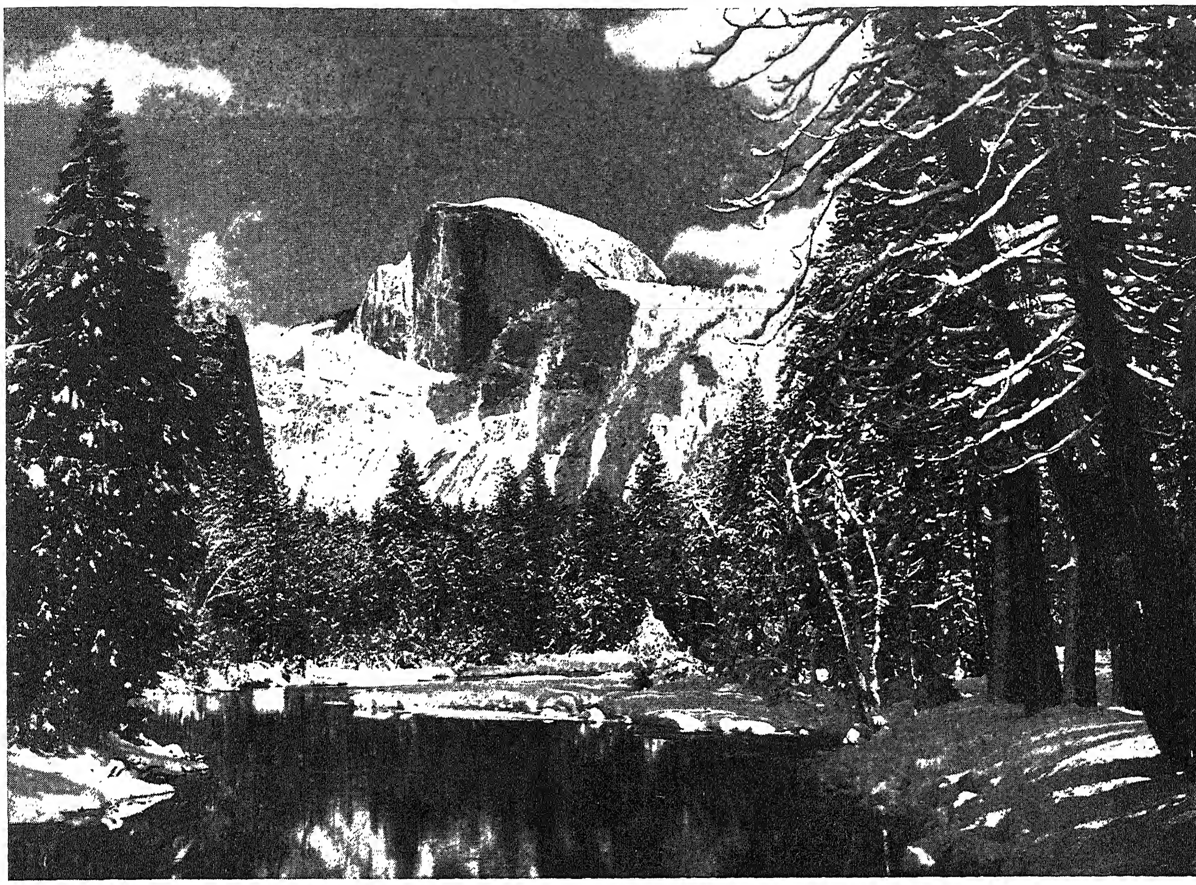
Print Developing Control

The foregoing is a typical procedure. It is relatively simple insofar as the printing is a direct process and no control of the print development was required. However, it is often that control of print development (and exposure) is necessary . . . more or less exposure and development than usual will change values in the print just as it will in the negative. However, we have one great difficulty to overcome when we alter printing procedure; the color of the print can undergo many unpleasant changes. Amidol seems to be the only developer that permits extreme dilution or less-than-normal developing time without altering the color to any apparent extent. Metol-Hydroquinone can yield a disgustingly poor color if the print is not developed for the full time specified. If a negative is too soft to give a good print on Brovira SOFT, and too hard to give a good print on Brovira MEDIUM (with normal developers) we can solve the problem by a procedure somewhat as follows: Dilute the Amidol solution 1 to 4 or 5 and try a test exposure on the medium grade. It will be necessary to give quite a prolonged development with this dilution. Dilutions of 1 to 5 up to 1 to 12 will make a considerable variation in the scale of the print, but unless the print is rather fully developed a veiled effect will result in the deeper tones. With fresh developer the color will be quite clean, and rich grays and blacks will be obtained. In normal solution, Amidol allows a flexible development time; the print can be withdrawn before full development with no appreciable change of color. In this respect Amidol offers the opportunity for greater control than does any other developer. We can also use the alternate water bath system on prints to restrain the deepest tones, especially with prints for reproduction purposes, with any developer (when print color is not of great importance).

A good "soft" developer is Agfa 120, frequently used in conjunction with Agfa 103 or 125. I find it exceptionally satisfactory for commercial prints for reproduction purposes.

Judging Print Quality During Development

One of the problems confronting all photographers is the proper judgment of print quality during processing. Print values are different in the developer, fixing bath, washing tank, on the racks when wet, and off the racks when dry. These differences are due to conditions in the emulsions—as immediately after development and before fixing, when there is considerable silver halide remaining in the emulsion—conditions of the solutions



2. WINTER . . . YOSEMITE VALLEY. A complete description about the making of this picture is given in the accompanying text by Ansel Adams.

(clear or slightly cloudy); intensities and colors of the various lights used in the darkroom; and the fact that prints dry "darker" than when wet. A beautiful print in the fixing bath may turn out disappointingly darker and duller when dry. Experience is the principal factor in compensating for these differences, but proper light adjustment is of great help. The safelight under which the prints are developed should be as strong as possible without danger of fogging the paper (in fact, the paper should be covered during most of the development). The light should be placed so that there is no reflection from the surface of the solution or the print. Its intensity and distance should be regulated so that it is easy on the eyes, and reveals the developing print as slightly darker than it really is. When the print is in the fixing bath it should be examined by a "daylight" globe of moderate brilliancy. Here the print should appear quite a bit lighter than desired when seen in full light, but it should appear about as it will when dry when seen with the light almost "on edge" with the paper. The full light on the surface will give a good idea of the tone color; the edge light will suggest the ultimate tonal value. Never judge a print when it is lying under the surface of any solution, even clear water. When wet, a print of any surface has a wonderful brilliancy; therefore a dull matte surface should appear exaggerated in brilliance when wet—and fairly light as well—as it will be both dull and darker when dry.

The basic objective test of print quality in the developer is to turn over the blank back of the sheet and make a comparison with the whitest white of the image. If this whitest white is appreciably grayer than the paper stock, we may be assured that the "whitest white" will be closer to a light gray when the print is dry. If we wish to preserve the whites with the utmost brilliancy in the dry print, we must be certain that no more than the faintest difference between these whites and the pure paper stock may be discerned while the print is in the developer. Conversely, it must be remembered that a strong fresh fixing bath can slightly bleach prints in a relatively short time; obviously, too long fixing will result in weakened light tones.

Always use a short stop—not too strong—between developer and fixing bath, and keep the prints agitated while in it for 30 to 60 seconds. Fix the prints for about ten minutes in an ordinary acid-hypo bath, then rinse them and transfer them to a plain hypo bath (fresh) for about 5 minutes (not more than ten). Then wash with great care. It is advisable to give several rinse baths before continuous washing starts; in that way much of the free hypo is removed and the general wash water is not contaminated. Wash for at least one hour in fully circulating water. Then make a sensitive hypo test. If the test is negative, wash another half hour for safety. If positive, wash another half-hour and test again. Prints MUST be properly washed. It is advisable to drain the prints every ten or fifteen minutes, replacing them in entirely fresh water. After washing is complete allow the prints to drain for some minutes, then lay them face up on cheesecloth and wipe off the surplus water with a clean viscose sponge. Then turn them face down and allow them to dry. When dry, place them between cardboards until ready for mounting.

Keep everything clean; chemicals, lint and dust will cause all kinds of troubles.

No single article—even a large book—could compass all the technical data related to modern printing and enlarging. The basic fundamental facts may be found in the numerous textbooks available, and more specific data sought for in technical journals or in the files of the research laboratories. New apparatus is constantly coming on the market . . . some of it good, some of it of questionable value. A relatively new enlarger may appear, excellent in every feature but one . . . the condensers are a fraction of an inch too small to completely cover the negative size for which the enlarger is advertised and presumably designed. A new paper is announced; it has a wonderful "scale" but the print "color" is atrocious. The writer has had two focusing magnifiers for enlarging that have been inaccurate . . . worse than useless. The veritable avalanche of equipment and materials that thunders on the market every year only confuses the serious student and worker. One naturally desires to have the best and most efficient tools and materials obtainable but is apt to flounder expensively in the photographic jungles.

Let the photographer work from within himself as much as he can, saying what he really has to say in the simplest possible terms. Great photography, like all truly fine art, may be compared to Faith—"The substance of things hoped for, the evidence of things not seen."

UNDERSTANDING PHOTOGRAPHIC PRINTING

MARTIN VOS

Whether it be lighting, posing, exposure, development or printing it will be conceded that to produce a good photograph, each step is of definite importance . . . one is always dependent upon the other just as the proverbial chain and the weak link. However, sight should not be lost of the fact that it is the ultimate result . . . the print . . . that must pass final judgment. It therefore becomes necessary to gather as much knowledge as possible about printing procedure so as to attain prints of fine quality.

Suitable negatives only will yield satisfactory prints. Much underexposed or greatly overexposed negatives can under no circumstances be expected to yield satisfactory prints. When exposure of a negative is correct it may be developed to any one of various stages of gamma or contrast, any one of which falls within the limits of good print yielding capabilities, provided the proper type of paper is employed. An underexposed negative is in no way to be likened to properly exposed negatives that have received minimum development, nor are heavy, overexposed negatives comparable to negatives of correct exposure and maximum development. In one case the densities are different and in the other the contrasts are different. Density should not be mistaken for contrast; one has no connection with the other. **Contrast** is the comparison of the densities of the shadow portion as compared with the density of the highlight parts. **Density** is the average of the color or blackness of the entire negative. **Overexposed negatives** lack full tonal range or contrast . . . they are flat. **Underexposed negatives,** on the other hand, produce no detail in the shadow portions and insufficient values in the half-tone parts. In either case it cannot be expected of any photographic printing paper to yield a print that gives something the negative does not possess. Every means therefore should be employed to produce negatives that have the necessary characteristics to yield good prints. If a negative does not have the requisite good qualities it is almost futile to try to produce a satisfactory print from it.

It is to be assumed that the photographer has reached the point where suitable negatives are being produced, so on to printing and print papers.

There are two main classifications to photographic printing papers. One is Printing Out Paper. It has an emulsion composed chiefly of silver chloride with an excess of silver nitrate. It is acted upon by very strong daylight and is therefore usable only for contact printing. It also possesses the characteristic of the image making its appearance during the process of exposure, an image that has a purple tone. When sufficient density is attained the image is made permanent by placing the print in a gold chloride solution after first removing the free silver by several washings in water. When the desired tone is reached the print is fixed in a saline or hypo solution. The final image is a brown tone, going from sienna to sepia and even to deep bluish brown.

The other classification of paper is **Developing Out Paper.** With these papers, after the exposure has been completed, the image is not visible; it is a latent image that must be developed out in the selfsame manner that the negative is developed. These papers are so very light-sensitive that artificial light is used with which to make exposures. Sunlight or daylight would be too powerful.

There are three common classifications to Developing Out Papers, **1) chloride papers, 2) chloro-bromide papers and, 3) bromide papers.** Chloride papers have an emulsion constituted chiefly of silver chloride in gelatin. The action of light upon them is rather slow, hence they are adaptable for contact printing. Chloro-bromide papers are made with a mixture of both silver chloride and silver bromide. This type paper is acted upon quite speedily. Some are faster than others. This variation is due to the proportions of silver chloride and silver bromide. Because of their fast working property, chloro-bromides are mostly used for projection prints. They can however be used for contact printing if the light source is cut down sufficiently.

Bromide paper is made with a silver bromide emulsion. These papers are very sensitive to light. Because of their great speed they have a definite place for use, principally, when very large projection prints are required, where the exposure for other papers would be too long.

Paper Grades And Surfaces

Since all negatives are not of equal contrast, each one requires a paper whose emulsion will yield a proper

scale of contrast for the particular negative. Because of this, manufacturers make most of their papers in a variety of contrasts. These degrees of contrast are indicated by labeling them "soft," "normal" or "hard." Others designate a number for each degree of contrast. In some instances they are termed as "extra soft" through to "ultra vigorous" with the intervening degrees called "soft," "normal," "medium," "vigorous" and "extra vigorous." Some papers are supplied in two degrees of contrast, others in four, and in some instances as many as six.

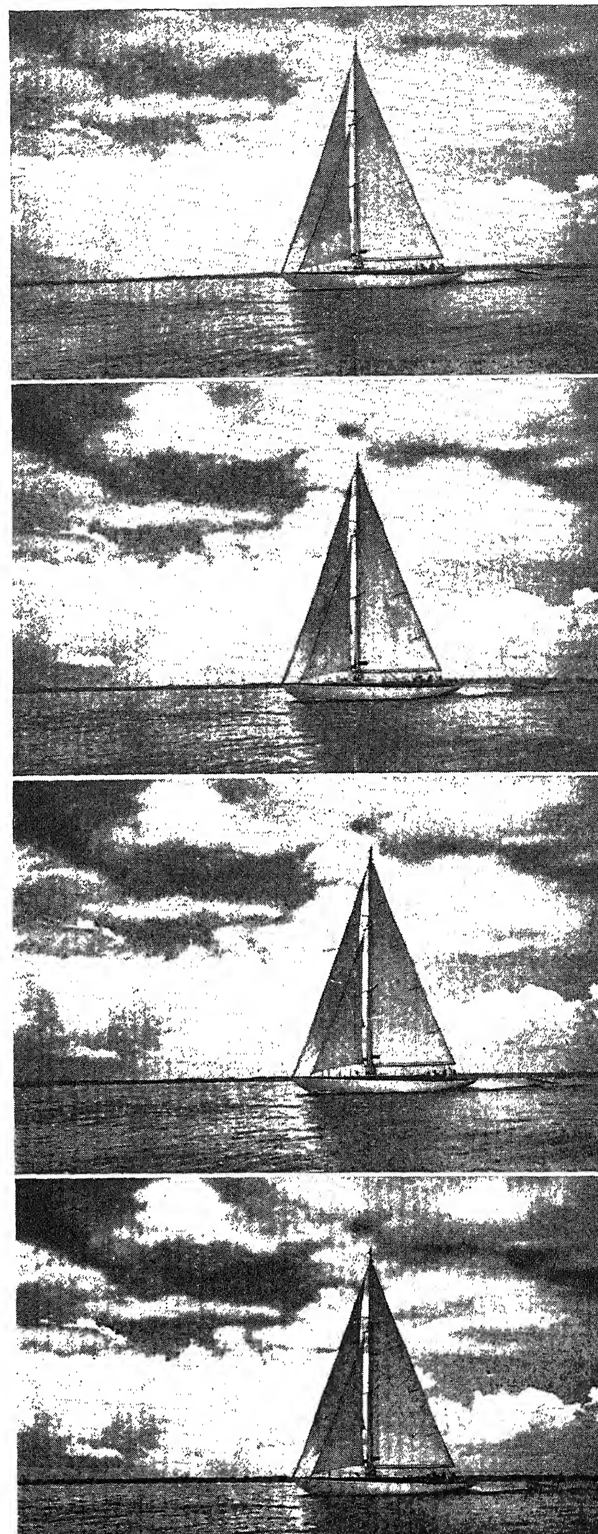
Then also there are various surfaces of paper. Glossy, matte, semi-matte and rough would be the chief designations, although there are some slight variations. The selection of surface is guided by the specific purpose of the print. Glossy prints are desirable when the photograph is to be used commercially or for reproduction. The smooth matte and semi-matte surfaces are popular where small prints are made. The other surfaces lend themselves to portraiture or enlarged prints for exhibitions, etc. where absolute detail is not essential or desired.

Papers coated with photographic emulsions are for the most part of two thicknesses . . . single weight and double weight. When only small prints are made, or where larger prints are to be mounted down, the single weight papers serve the purpose. Where larger prints are made, prints that are not to be mounted, the double weight has the advantage of staying flat and will also prove to be more durable.

While most printing is done on white stock paper, there are some who have a preference for a slight tone in the paper. For those, there are some papers where an ivory or buff paper has been coated.

Negative And Paper Contrast

Since papers are manufactured in various degrees of contrast it is necessary to fit the correct grade of paper to the negative to be printed. To do so makes it necessary to know the characteristics of each degree of contrast and what it will yield. The contrast designation of a paper tells what contrast that paper will yield, not what kind of a negative is required for the designation. If a negative is somewhat lacking in contrast, then contrast will want to be added to the print. The selection of a "hard," or "vigorous" or "contrasty" paper emulsion will do this. On the other hand, if the negative is one with more contrast than is desired, the print will be softened or made less contrasty if printed on a paper designated as "soft." This applies to all negatives regardless of density . . . this is important to remember, for too often, density is confused with contrast. A dense negative may have a very short scale of tones and will require a contrasty paper. The density only means it will require a longer exposure to allow sufficient light to pass through it.



1. Four different prints from a single negative made on various paper contrasts, soft, normal, medium, hard.

To select the correct degree of contrast-yielding paper requires that the eye can determine between low contrast, normal or high contrast negatives. It also necessitates the ability to determine the intermediate degrees af contrast, because papers are manufactured in as many as six degrees of contrast.

One's own individual taste, or the purpose of the print, is the guiding factor in determining the surface or the color of the print paper—but only the negative determines the degree of contrast to be used. A set of prints from a single negative made on various contrasts of paper clearly show what happens to the shadows and the highlights. The prints on Figure 1 are an example.

Tone Quality And Exposure

Emulsions of printing papers have less exposure latitude than negative emulsions. When a negative receives more than double the exact correct exposure, or only even less than half the proper time, it will still produce a usable negative. An exposure on paper of twice the correct time, or of only half the needed exposure for the print rarely yields good tone quality. The question of what constitutes good tone quality is something that may be determined by a photographer's own personal likes and dislikes. Even so it will be conceded that a print should possess the fullest possible tone range that the negative is capable of yielding if it is to qualify as a satisfactory print. The highest highlights should be a clear white, while the light areas just below the highlights should have a faint deposit of silver, and so on down the scale till the deepest shadows are a good black tone. Of course if pictures are made purposely in a low key the darker parts do not approach black tones.

It may occur that with a given exposure and proper development time a print has the desired tone values in the white and lighter areas but is lacking color in the dark portions; or it may be that the dark tonal range is good but the lighter parts unsatisfactory. Assuming the proper developer has been employed the indications point to the use of the wrong grade or contrast paper for the negative.

Factors entering into the determination of the length of exposure are, density of negative; color of negative; intensity of light source; grade, make and speed of paper used, and duration of development.

The length of exposure for a negative to yield a print of full tone gradations may vary. Correct exposure has some latitude, it has a minimum and maximum exposure time compensated for by maximum or minimum developing time.

Minimum developing time is the shortest time required for a print to build up its full tonal range from deepest shadows, through the half-tones and the highest light areas. After a prolonged developing time the print will begin to pick up a general fog or gray tone, as well as become yellow or discolored. Just prior to this occurrence is the maximum developing time. With this exposure and development latitude it is apparent that with the longest possible exposure before overexposure, a print will reach its full tone range at the minimum development time, whereas a print exposed for the shortest yet not underexposed time would require the maximum of development to produce the full scale of tones.

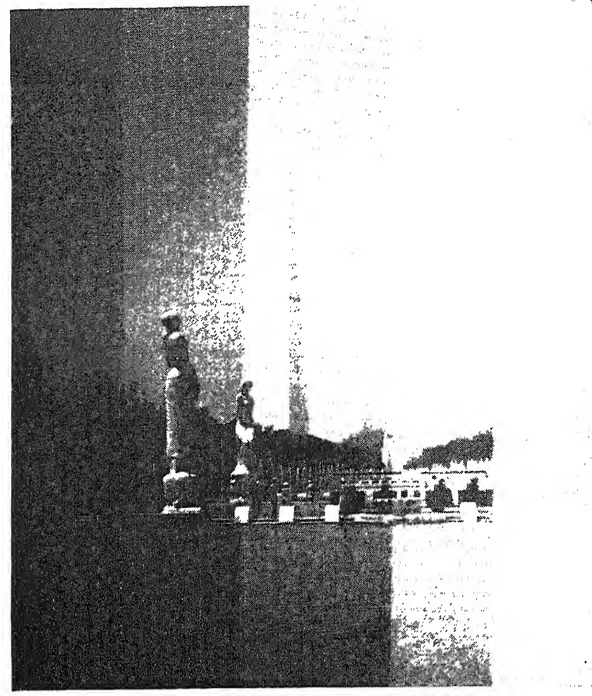
2. THE MUSICIAN. One flashbulb on camera, photoflood at right. 3¼ x 4¼ Speed Graphic, 1/100 second, f/11, Fast Pan film. Photographer Jonas Mandelstamm stood on ladder to get this angle shot.

3. "WHAT HAPPENS NEXT" A first prize winning picture by Clyde Brown of the Chicago Daily News. 4 x 5 Speed Graphic, synchroflash, one bulb at right and one bulb on camera, 1/100 second at f/11, Fast Pan film.

Testing For Correct Exposure

A safe, practical and dependable method of arriving at correct exposure may be accomplished by the following method when contact prints are made. The negative in contact with the print paper is placed in the printing frame, and set at a given distance from the source of illumination that is to be used during the exposure. After the light has been turned on for 4 seconds cover 1/5 of the frame with an opaque card. At the end of 8 seconds move the card so as to cover another 1/5 of the frame. This is repeated at 16 seconds and the final 1/5 receives another 4 seconds exposure or 20 seconds in all. The paper has now five different exposures running as follows: 4, 8, 12, 16, and 20 seconds. The entire sheet of paper is developed as recommended by the manufacturer for the normal length of time prescribed. The result obtained is that shown in Figure 4.

It will be observed that the strip that received 12 seconds exposure has a full range of well-balanced tones from highest lights on down through the shadows. This then would indicate that the proper exposure time for the negative in question would be 12 seconds provided the print is exposed and developed under the identical circumstances—the same light source, the same distance from the light, the same grade paper and the same developer at the same temperature and the same length of developing. Figure 5 shows a print made in this way.



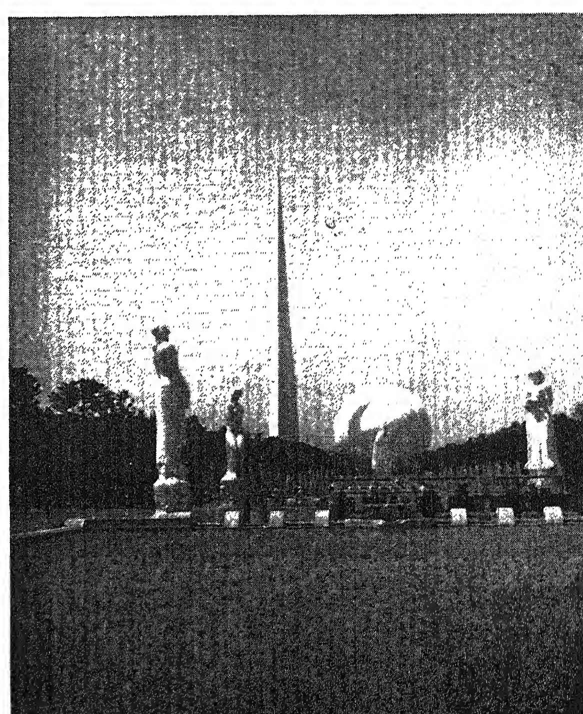
4. This is how the test strip looks after making the five successive exposures as described in the text on this page.

When making projection prints a similar procedure is used, except that the covering of section after section is done by moving the opaque card across the paper at regular intervals so as to yield a series of exposures from short to long.

Selection of the correct grade of paper and giving the proper exposure must be coupled with proper developing.

Inasmuch as the leading manufacturers of sensitized papers have well-equipped research laboratories where they utilize these facilities to work out the most suitable developing formulas for their products, and whereas they publish the recommended formulas with each product, it would be indeed unwise for the average photographer, amateur or professional, to ignore them and to work out his own formulas.

Because of this conviction this chapter will omit any specific formulas, but urges the use of formulas as recommended by the manufacturers. There are certain inherent characteristics to each brand of photographic paper, characteristics the manufacturer has become apprised of and has therefore worked out a formula to suit his product. Thus one can understand the wisdom of heeding the advice of the manufacturer and adhering to his recommendations.



5. After making the above test for exposure this print was given 12 seconds exposure to obtain a normal printing time as indicated.

Chemicals For Developing

Reading the list of chemicals that go into the making of a developer we find five of them as a general rule dissolved in water. Each one plays its specific part. The work of these chemicals in developing prints is identical to what takes place when developing a negative. The emulsion on the paper has been struck by light in vary-

ing degrees, influenced by the numerous tones of the negative that are placed between the paper and the light source. When this paper is placed in the developer a chemical change is brought about in the silver salt that is in the emulsion. What is brought about in this chemical change is that, where a great amount of light has been able to fall upon the paper, we will find a heavy deposit of silver which appears as a black tone. Where light has fallen in a lesser degree, the silver deposit produced will render the color of gray. Where very little light has been able to penetrate the negative the result on the print is a very faint gray, and if the negative has any opaque tones preventing light from passing through, the paper remains white. In this manner the tones of the negative reverse themselves on the print and produce a positive picture from the negative. This then is the work accomplished by the combination of the chemicals in the developer. But why are so many chemicals required and what does each one do?

The formula is given the name "developer" because it contains a chemical known as a developing agent. There are many such agents. Those most commonly used are **metol** or **elon, hydroquinone** and **pyro.** Pyro is used only for negative developing because it oxidizes very readily and causes a brownish stain which would be harmful to paper but of no detriment in negatives. Metol and hydroquinone are both employed in a single developing formula. Each has a different characteristic and these two in combination are ideal working partners. **Elon** or **metol** produces an almost all-over image at the same time and allows the shadows and other darker portions to build up gradually. Elon alone as a developing agent would give too soft a print.

Hydroquinone brings out the shadows and other dark parts first. After they have built up quite some color, the half-tones then begin to develop out and finally the very delicate light tones. During this time the shadows continue to build up. As a developing agent, hydroquinone alone is not advisable.

Just as two kinds of coffee beans or two kinds of tea leaves are blended to give a smoother flavor, so the combination of metol and hydroquinone creates a blend to give full tone values to a developing solution.

Unknown to man is the exact action of light falling on the silver salt emulsion, but it is felt that it has the action of freeing or starting the freeing of the silver from the silver salt. This action is fully accomplished by the later action of a chemical in the developing solution, the chemical called the developing agent such as the metol or hydroquinone, etc. Since this action is started by the light, it is natural that where a greater amount of light falls on an emulsion, there will be a greater amount of silver released from the salt, and the greater the amount of silver the darker is that part of the picture. **The work then of a developing agent is to release the silver from the silver salt.**

Developing agents have a characteristic of quickly oxidizing or combining easily with oxygen, causing them to deteriorate. To eliminate too fast oxidization **sodium sulfite** is added to the developing solution. Sodium sulfite has a greater affinity for oxygen and takes up the oxygen before the developing agent can do so. It acts as a preservative.

Most developing agents are on the acid side, a condition under which its action is very slow. So as to accelerate or quicken the action of the developing agent the solution is made alkaline by adding sodium carbonate. The addition of **sodium carbonate** also causes the gelatin of the emulsion to swell, thus permitting the developing agent to reach the embedded silver salt and accelerate or speed up the developing.

A developing solution composed of only the developing agent, preservative and accelerator produces a slight silver deposit over the entire print as it is being developed—it liberates the silver too freely. The effect is that of a fogged print . . . one that is devoid of any pure whites. To avoid this too fast action of liberating the silver, the developer requires a restrainer, something to retard the action. This action must not be too strong but just sufficient to restrain any silver deposit in the highlights so they are pure white. **Potassium bromide** is the chemical that does this work.

Short Stop and Fixing Solutions

After a print has been developed to the full tones desired, it is removed from the developer and placed in a rinse bath to stop the further action of the developer. The rinse bath contains some **acetic acid.** It will be remembered a developing agent should be alkaline, hence the acid rinse bath stops the developing action quickly.

However this is not sufficient to completely prevent further developing action. The print still holds the silver salt that has as yet not been affected by the light and the developer. This surplus silver salt must be gotten rid of. To do this the print is placed in the **hypo or fixing bath.** The chief ingredient of this fixing bath is **sodium hyposulfite,** commonly called hypo. This chemical has the ability of quickly dissolving out all the remaining silver salt that had not been acted on by the developer. It also can dissolve the silver image if given enough time, hence it is advisable not to keep prints in the fixing bath for too long a time. Five to ten minutes in a fresh bath should suffice.

Hypo alone will do its work well for only a short time because some of the developer is brought along with the print and as the amount of developer brought into the hypo increases, it will cause the prints to pick up a yellowish stain. A developing solution must be alkaline to do its work, so if acid is put into the fixing bath it will neutralize the developer that is carried over into the hypo bath, so acetic acid is added to the hypo solution. However, before the acetic acid is added, sodium sulfite is put in first. The function of the sulfite here as in the

developer also is of a preservative nature. If the sodium sulfite was not put in first the acetic acid would decompose the hypo and cause the solution to become milky and change its chemical make-up and render it useless.

The sodium carbonate in the developer made the gelatin surface of the print swell up. In this swollen state the gelatin which holds the silver image can very easily blister or peel off the paper support. To avoid this the gelatin must be hardened. The adding of **alum** will harden the gelatin.

If any hypo remains in the gelatin or paper support after the print has been washed and dried it will in time to come affect the print, causing it to discolor and fade, hence it is imperative that if the print is to be of lasting quality it must be washed for a long period so every trace of hypo is dissolved out of the print.

Length of Developing vs. Exposure

To know the chemicals that go to make up a developing solution and their function is not sufficient. It is very necessary to learn just what effect developers have on prints under various circumstances, such as length of developing combined with length of exposure, especially since it has been said that there exists a minimum and maximum exposure limit to the paper emulsion.

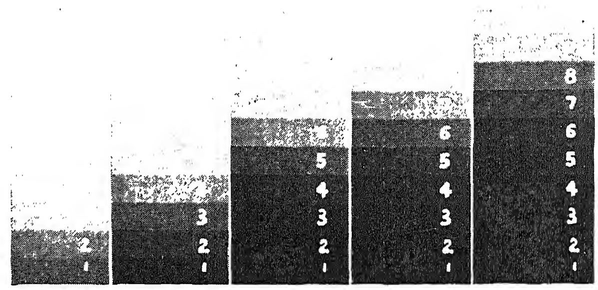
Previously, through a succession of various exposure times, as shown in plate 4, it was determined that the proper exposure of 12 seconds for a 45 second development was correct.

In making another test using 45 seconds as a basis of developing time it will be interesting to study the results when a gray scale or step wedge is used. This step wedge commences with the bottom space of clear film followed by a space with a slight tone, and each succeeding section or space adds still more of a tone so the densities increase in regular steps.

Five strips of paper are exposed through this step wedge. The first one for 4 seconds, the next for 8 seconds, one for 12 seconds, another for 16 seconds and the fifth one for 24 seconds. This is quite a variety of exposures. All are developed for 45 seconds. The results are shown in Figure 6.

The strip *A*, which received 4 seconds exposure, has not developed nearly the tone range that would be wanted in a print. It has only a range from white to a medium gray. *B*, the strip that received 8 seconds exposure, comes nearer to the tone range desired, but the dark end is very short. *C*, the 12-second-exposed strip, has a goodly portion of dark tones and a long scale into the grays right up through to white. It would appear that this 12-second exposure combined with the 45-minute developing gives the full desirable tone range as each step has a decided separation. *D* has already begun to close up at the dark end, the steps 1 and 2 show no separation, and *E* has no separation in the four lower steps. The conclusion then would be that 12 seconds exposure with 45 seconds developing yields the correct print.

If strips *A* and *B* were given proportionately longer developing, and if *D* and *E* were given proportionately



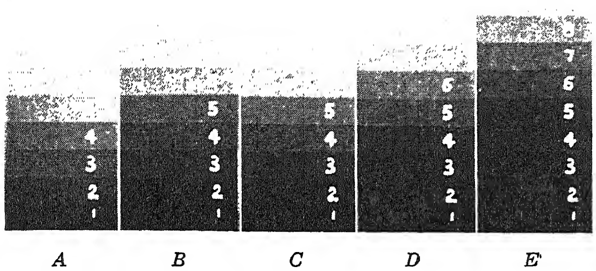
6. The above five strips of paper were given successive exposures of 4, 8, 12, 16, and 24 seconds. All developed at the same time for 45 seconds.

shorter developing would these longer and shorter developments compensate for the shorter and longer exposures?

Five more strips are exposed exactly as before for 4, 8, 12, 16 and 24 seconds. This time *A*, is developed for 2 minutes, *B* is developed for 1½ minutes, *C* is again developed for 45 seconds, *D* is developed for 30 seconds and *E* is developed for 20 seconds. The results are shown in Figure 7.

A comparison with Figure 6 is quite interesting. *A* has built up a great many more steps, has even added a black step . . . but the dark end of the scale is too short. *B* has added enough steps to the dark range to make it almost identical with *C*, and *D* also, by the reduced developing time, has fallen into the same range as *C*. *E* is still a little too heavy on the darks but is not so far away from the tone range of *C* as in the first test.

The conclusion must be that the tone range of prints of different exposure times can be made to look alike if exposure is compensated for by length of development. Of course these variations must never exceed in exposure or developing what has been found to be the maximum developing times. Nor must the exposure or developing be less than the determined minimum exposure or developing times. If these minimums and maximums are not adhered to, the prints will suffer in one case from too



7. The above five test strips were exposed exactly the same as shown in Figure 6. However, this time the development varied from 2 minutes on the left to 20 seconds on the right. See text for complete explanation.

short a tone range and in the other too heavy at the dark end. Then too the fog or stain of forced development when too prolonged may ruin the print.

An interesting observation is that for a given exposure within the latitude range of the paper at a certain time which would be called proper length of development, the entire range of tones from highlights down to shadows attain their proper values all at the same time. In the case of the strips *B*, *C* and *D* in Figure 7 this occurred when *B* was developed 1½ minutes, when *C* was developed 45 seconds and *D* 30 seconds.

When prints are made on bromide papers the tones are bluish black. Chloride papers also are bluish black with some developing formulas, but can be given a warmer color when a developer with less carbonate and more bromide is used.

Chloro-bromide papers are of the warm tones and with dilute developers, increased exposure and short development the color can be made even more warm toward the olive brown tone, especially so with less carbonate and when more bromide is used.

Making Enlargements

Most photographs of this day and age are taken on small negatives. With the Graflex and Speed Graphic the most popular sizes are 3¼ x 4¼ inches and 4 x 5 inches. While prints of this size are large enough to see the picture and its details, most photographers make projected or enlarged prints from many of their negatives, or from only a portion of the negative.

Prints made by the projection method are in no way different from contact prints, except of course the size and the use of only the faster papers, bromide and chloro-bromide.

Making enlarged prints however has a very decided advantage in that it permits a greater use of local control. Regardless of how correct may be the exposure and development of a negative, there are always discrepancies of color values of one portion of the picture with another. These clashes of color are beyond our control in the negative, because when we photograph reds, blues, greens, yellows and all the other colors that happen to be in the subject, their values in the monochromatic rendition of the negative are beyond our complete control. Thus there are parts of the picture that appear lighter than is desired and others are too dark.

These lighter parts can be made darker by allowing that portion of the negative to be exposed for a longer time while printing. On the other hand the darker parts can be controlled so they will be lighter, by cutting off the exposure of that part during a portion of the exposure for the rest of the print.

A very convenient way to overcome the too light portion by the additional printing-in, is to make two cardboard cutouts as shown in Figure 9.

The square card has holes of various shapes and sizes cut into it. The second card is cut to make a disc with a segment removed. This disc is placed on top of the square card as shown on insert in Figure 9. It can be turned so any one of the cut out shapes is exposed. The cut out that has a shape more nearly like the part to be printed-in or made darker, is brought to a position where it will appear in the open part of the disc. After the entire print has received the full exposure the printing-in of the part that otherwise would be too light is undertaken.

The gadget with the hole is held between the enlarger lens and the printing paper. It is held in such a position that the opening permits only the part that is to be printed in to be projected on to the printing paper. The card of course holds back the light from all the other portions of the negative. By holding the gadget near or farther away from the lens the size or amount of the image it permits to show through the opening can be controlled. While making the exposure through this opening the gadget should be kept in a slight circular motion so as to avoid sharp edges. When it is desired that parts of the picture which print too dark are to be lightened, it is accomplished by holding back that part of the image for a portion of the exposure. This can be done with small circular or oval pieces of cardboard at-

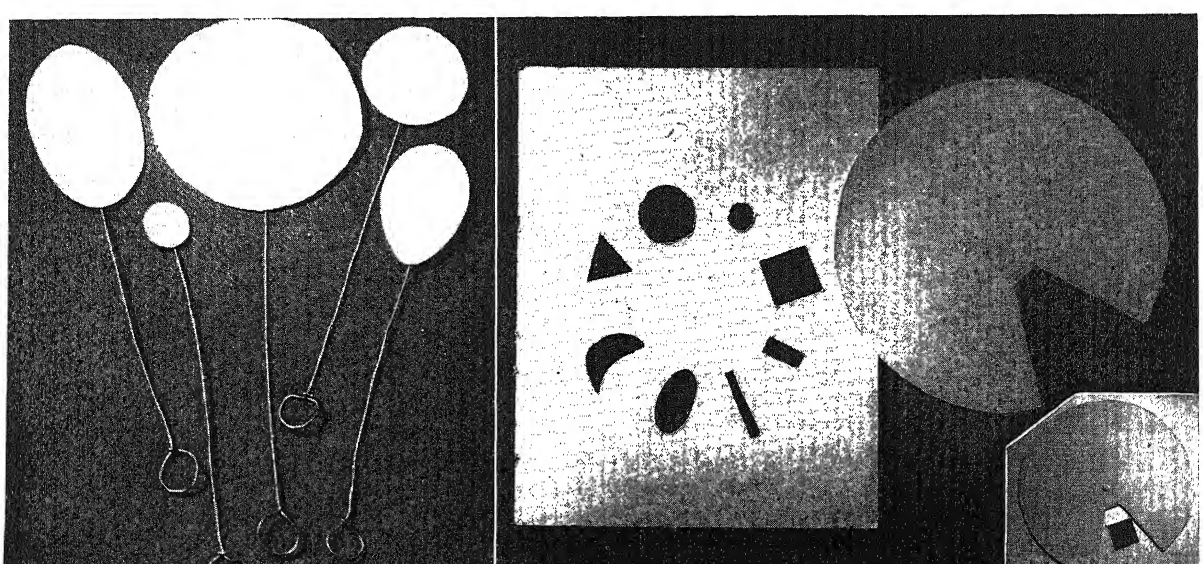
tached to thin wire as shown in Figure 9. Just as with the other gadget, these are interposed between the lens and the print paper so they cast a shadow where the image is to be held back. As before, the size of the shadow is controlled by the distance of the gadget from the lens. They too should be kept in motion during exposure.

Figure 8 shows two prints from the same negative. A is a straight print without any printing-in or holding back. The sunlit foreground is too light and the tree trunks too dark. B is one where some portions are held back and others are printed-in. The foreground is dodged in darker and the tree trunks held back, so both have details. The difference and the improvement of the picture can readily be seen.

Print control can be accomplished in still another simple manner where two trays of developer are put into service. Most manufacturers recommend a soft working and a more contrasty developer. The Eastman Kodak Company in its formula recommendations gives D52 and D72. The former is inclined to yield prints that lean to the soft gradations and build up slowly, the shadows building up darker only after a time. The latter works faster and brings out the shadows quickly, the other tones building up later on. This is so because the proportions of elon and hydroquinone are different, and especially a different content of sodium carbonate and bromide.

One tray holds the soft working developer, the other tray the more contrasty developer. Then too a small graduate or any convenient receptacle is required wherein is kept some of the concentrate contrasty developer. If the negative to be printed is one which leans to the heavy yet contrasty side, one where the highlights are black or choked, it would be rather difficult to secure a print of well-balanced tones by straight printing. If, however, the print is given the maximum exposure and first placed in the soft developer till it is fairly well developed, then transferred to the more contrasty developer so as to get quick action into the shadows before the half-tones and shadows can develop too far, a better balanced print can be produced. It may be that certain

8. Straight print at left without any dodging. Right hand print shows result of shading and giving the foreground more exposure in order to bring out better details.



9. With a few easily made shading and dodging accessories, wonderful improvements can be made in your printing. The shading forms are easily cut out of cardboard with scissors or razor blade. The special shading outfit at the right has various sizes in order to fit different portions of the picture.

portions of the negative are extremely dense and would show no tones by this means of developing. If, however, a wad of cotton is soaked with the concentrated developer that is held in the small container and is rubbed on the print where these very dense parts are to be developed up it will be of some material aid in forcing out some tone in that part of the print. This is done while the first developer is being used. It will readily be seen that this method is more adaptable to contact prints whereas the dodging and printing-in method as described before lends itself better to projection printing.

The small receptacle of concentrated developer is always a handy thing to have nearby while developing—for it often happens that some portion of the print needs coaxing and the applying of this concentrated developer with a wad of cotton is of invaluable help.

There may arise occasions where a portion of the print is developing too fast and would be too dark by the time the balance of the print is completely developed. This too can be controlled. That part of the print where development is to be retarded is held under the water tap allowing the water to wash away the developer. This does not completely stop development at that part, but retards it sufficiently so the other portions catch up with it.

Printing Troubles . . . Fog, Stains, Spots

Occasions arise where prints lack brilliant highlights and have the appearance of a slight all-over fog. Before placing the fault on the paper or the manufacturer it will be a good policy to check on the safelight. Manufacturers recommend the type and strength of safelight to be used with their papers. Nevertheless many photographers do not heed these instructions and even make their own safelights. In any event it is a good policy to check your safelight so as to be able to place the cause of fog or lack of highlights in the print. Place a piece of print paper about 3 or 4 feet from the safelight. Cover half of it with some opaque paper or cardboard. Allow it to remain for two minutes, then place it in the developer for two minutes. If the half of the paper that was exposed to the safelight develops a gray tone you know your safelight is too strong. If you feel certain the cause is due to a defect in the paper place half a sheet of the questionable paper into the developer allowing the other half to remain out of the developer. After two minutes remove and examine. If the half that was in the developer shows any gray tone then the paper is at fault, assuming of course that the developer is all right.

What photographer is free from trouble or error? It is through these errors we learn and each one must be charged up to experience. Experience makes it possible to quickly determine the why and wherefore of some of the troubles encountered in photography.

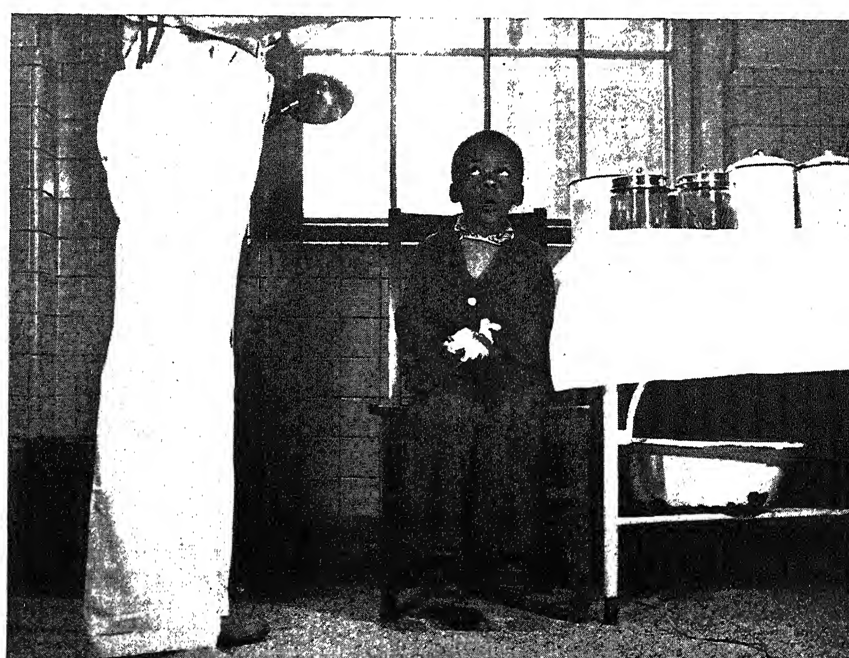
Some of the more common troubles and causes with prints may be listed as follows:

Yellowish Stains.

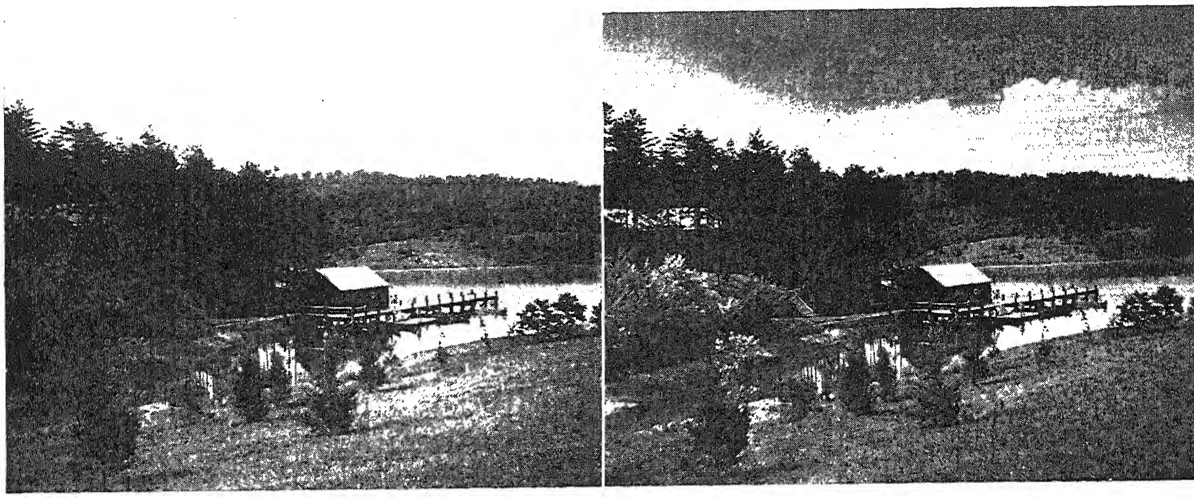
Insufficient moving of print when placed in the fixing bath.
Forcing development beyond maximum developing time.
Weak or exhausted developer.
Left in the fixing bath for too short a time.
Fixing bath too weak . . . Insufficient washing.

Dark Gray Oval or Round Spots.

Caused by air bells when print is transferred to fixing bath permitting development to continue its action where air bells prevent the hypo from coming into contact with the print.



10. GO EASY, DOC! This excellent photograph is full of direct human interest appeal. The photograph could have been improved slightly by exposing the white table covering and also the white duck pants of the doctor a little longer. This would give a little better detail and depth to the picture. Photo by Ted Leigh.



11. When skies are over-exposed it is impossible to obtain a balanced paper print and preserve all the gradations. The picture on the left is such an example; however, by holding back the exposure among the trees and giving the sky a longer exposure, it was possible to obtain the final print on the right. 4 x 5 Speed Graphic. J. Sherrel Lackey Photo.

White Round Spots.

Air bells on surface of print during developing.

Round Spots Not as Far Developed as Balance of Print.

Also caused by air bells which have come away from print, after print has been developing for a while.

Entire Print Too Dark.

Developer too warm.
Print overdeveloped, or print overexposed.

Entire Print Too Light.

Developer too cold, or print underexposed.
Print underdeveloped.
Left in hypo bath too long, silver having been dissolved, especially when hypo was new.

Graininess In Entire Print.

Overexposure and removal from developer before complete development. The emulsion breaks down and shows very granular.

Dull Whitish Deposit Irregularly Spread Over Emulsion.

Caused by exhausted hypo bath that has a white milk-like aluminum sulfate sediment, which adheres to the gelatin surface.

General Fog or Gray Tone over Print.

Accidental exposure to light.
Safelight too strong.
Old paper, or forced development.
Contamination with certain harmful gaseous vapors.
Insufficient restrainer in the developer.

Blisters.

Too great a difference of temperature of developer and fixing bath or wash water.
Insufficient hardener in fixing bath.
Temperature of solution too high, causing gelatin to become too soft and easily blistering.

Dirt is always an easy cause of troubles.

Keep your darkroom, trays and bottles clean, it will be a great help to good prints and also simplify your work.

Toning Photographs

While the majority of prints one sees are the conventional black and white silver image, there also appear prints of various brown shades as well as some of red, blue, and green.

These prints are known as toned prints. The process or processes of toning change the black and gray silver image as originally developed into some other substance such as silver sulfide where brown prints are made and where other colors are desired, to a ferricyanide compound of copper, uranium, iron, etc.

The final print, regardless to what color it is toned, is dependent upon the amount of silver deposit the original print received. The greater the silver deposit, the richer the color of the toned print, therefore the print should be fully exposed and developed for a normal length of time, not too long nor too short.

When prints are toned brown the most common processes used are called Sulfide Processes. This is so because the original black silver deposits are converted to silver sulfide, a combination of sulfur and silver, which has a brown color. There are many methods of sulfide toning; they are subdivided into two classes: 1) Direct Sulfur Sepia Processes, and 2) Indirect or Redevelopment Processes.

Indirect Toning

The indirect process requires that the silver be first converted into either chloride, bromide or iodide, then into sulfide. To accomplish the conversion of the silver into the bromide the print is placed in a solution composed of potassium ferricyanide and potassium bromide. Through a few chemical reactions this solution changes the black silver image into a very light yellowish image, a silver bromide image. Because of the very pale color of this image it is considered a bleached image . . . thus the first operation is usually referred to as the bleaching of the print. The second step in this process is to convert the pale silver bromide image into a silver sulfide image which is brown in color. This is accomplished by placing the print into a solution of sodium sulfide (Note this is sul*fide*, not sodium sul*fite*, the chemical used for the preservative in the developer). This solution converts the pale silver bromide to the brown silver sulfide. There are many different shades of brown that this process yields and several factors go to determine this. The greater the carbonate content and the smaller the bromide content of the original developer when the print was developed, the darker brown or more purplish will be the redeveloped brown print. A prolonged original development also tends to give a dark brown print. On the other hand, when less carbonate and more bromide are the make-up of the developer, then the lighter and warmer are the resultant brown tones. This too is the case when the development has been accomplished in a time considered normal.

By this process of redevelopment it is possible to bring off some interesting two-tone effects. There are two simple ways in which they can be manipulated. The first method is to remove the print from the bleaching solution before the print is entirely or completely bleached, when the shadows show a considerable amount of black silver deposit. If in this state the print after rinsing is placed in the sulfide the completely bleached portions will be converted to the light brown tones, while the portions that still contain the black silver will be quite a decided purplish brown. Very frequently some extremely pleasing results are accomplished in this manner.

After a print has been bleached it is possible to bring it back to its original black silver state again, simply by placing it in the original developer. With this knowledge then, it will be seen that if after complete bleaching some of the original developer (in a very diluted state) is applied locally with brush or cotton to certain portions, those portions can be made black again without affecting the remainder of the print. After the desired amount of local work has been done the print after a rinse bath is ready to be immersed in the sulfide to bring on the sepia colors, creating a two-toned picture.

If prints have been made under conditions that will yield light brown images by redevelopment, but dark browns are desired, this too can be accomplished. After the print has been bleached and before placing it in the sulfide bath the print is placed in a very dilute developer. This gradually brings the print back to its original unbleached state, however it is not left long enough for this complete action to take place. When the print has come back to a deep yellowish brown, it is removed from the developer, rinsed and then given the sulfide bath. The result will be a darker brown than would have been obtained were the print not brought back a little by the dilute developer. The depth of the brown color image can be controlled, it being dependent upon just how much the print is allowed to come back to its original black color. The more it is brought back the darker will be the brown redeveloped image.

During these redevelopment processes a somewhat disagreeable odor of a sulfur gas is given off. Aside from being disagreeable these fumes are very injurious to sensitized emulsions . . . either film or paper . . . they cause a chemical fog. This makes it advisable to do any such redeveloping in a room where no film or paper is stored.

Hypo-Alum Sepia Toning

The direct toning mentioned before is one where the conversion of the black silver image to brown is accomplished in one direct operation. The most common is known as Hypo-Alum Sepia Toning. The principle involved is the fact that free sulfur readily combines with silver. When discussing the chemicals that go toward making the acid hypo fixing bath mention was made of the fact that if the hypo and alum were mixed before the acid was mixed with the hypo, there would be a chemical reaction and it would cause a white precipitation. For the hypo-alum toning bath this precipitation is needed, so these two chemicals are the chief ingredients. This white precipitation gives off free sulfur which combines with the silver image making a silver sulfide or brown image.

The hypo-alum mixture has a tendency to dissolve out some of the silver image of the print. To offset this a buffer or ripener is added in the form of some silver salt, usually silver nitrate. Even so the image is attacked, hence it is necessary to make the original print a little darker than ordinarily. With low temperatures the action of this hypo-alum bath is too slow. To speed up the action such solutions usually are used at a temperature of at least 110 degrees Fahrenheit which will bring about the change of color in about twenty minutes.

Some formulas known as Gold Toners are similar to the hypo-alum baths with an addition of gold chloride. These baths produce richer sepia tones which are more toward the bluish or purple-brown color.

Still another direct sepia toner and a very simple one is made of a solution of Liver of Sulfur. This too is used at a high temperature. The tones, however, are unpredictable . . . they vary quite a lot. These direct toners give unsatisfactory results with straight bromide prints. They are very suitable with chloride and chloro-bromide papers.

Where prints are toned to such colors as blue, green, red, etc., this is accomplished by a Ferricyanide, copper ferricy-

anide and uranium ferricyanide to convert the original black silver images to colored metallic compounds. In some cases this action is accomplished in a single solution while in others a double solution, one a bleacher and then a toner is used. These processes give many shades of the various colors. Formulas for these toners are quite numerous. In the book, PHOTO-LAB-INDEX, published by Morgan & Lester, all the recommended toning formulas will be found in handy reference form.

Multiple Toning

Many interesting prints can be made by what has been termed multiple toning. These prints when done skillfully resemble full color photography. A brief outline of this multiple toning may be summarized as follows: Cover the print with a waterproof covering, leaving exposed only that portion to be toned to the desired color. After the exposed part of the print is toned and the print dried, the waterproof covering is removed. This time the print is again covered with the waterproof substance, leaving exposed only those portions that are to be toned to the next color. This is repeated until all parts of the print are toned to the various colors.

For the waterproof substance to be used, two have been found to be very excellent. One is rubber cement that is colored by the addition of English Vermilion. This is applied to the print with a small paint brush and is very easy to remove from the print by simply pressing the finger tips on it and drawing them along the surface of the print. It will peel right off. The other substance used is the ordinary quick-drying lacquer paint. This too is applied with a small paint brush. To remove it the lacquer solvent is used. Prints made by this method usually require some slight retouching to eliminate harsh edges, etc.

Conclusion

Perhaps of all the steps required in the making of a photograph none is more satisfying than the making of the final print . . . it is the everlasting reward for all the effort that has gone before. It is in the printing that errors of judgment in the exposure or developing of the negative can be compensated for and corrected provided the errors are not too great. In the printing one has so much leeway and latitude for self-expression and individuality. Regardless of the season of the year or the hour of the day, whether it be inclement weather or not, it is always printing time. Photographers need never have any idle hours hanging o'er their heads; time need never drag on with nothing to occupy the mind or attention. Just pull out some negatives . . . mix the developer and start in to make your prints . . . and see how greatly you can improve on the last ones. Remember, each print that leaves your darkroom and finds its way into the salons or homes is part of the yardstick by which your ability as a photographer is measured. And you want that opinion to be a good one, don't you?

KODACHROME PHOTOGRAPHY

JOHN W. McFARLANE

The basic aim in all good photography is exact reproduction of the scene before the camera. While such reproduction can be attained in black and white with respect to line, mass, lightness or darkness, etc., one most important attribute is lacking—that of color. Good color photography, therefore, is a long step nearer the ultimate goal—the recreation of reality.

Kodachrome Professional Film, a direct color film in sheet form, is now widely used in Graflex and Graphic cameras. This film is relatively simple to use and yields excellent transparencies that bear three superimposed color images which automatically insure correct register in the original.

To be useful and practical, a color film must be complete in itself without recourse to special optical devices added to the camera or projector. The ideal color film would be one having a single emulsion which, when processed, would produce an image in the exact colors of the subject. No such material has yet been invented.

Fortunately there is a practical approach to the problem of color photography which is based on the fact that color vision appears to be due to three primary color responses of the eye. If the elements in the eye giving rise to these three responses are stimulated in the proper proportion, the sensation of any desired color may be produced. Thus, stimulating the blue and green elements gives rise to the blue-green, and so on. Because of this behavior of the eye, it is possible to make color photographs by using three colors of light, namely red, blue, and green. From these may be derived all intermediate colors.

Two general methods are in use to produce the required color sensations in the eye.

An example of one method involves the use of microscopic dots of red, blue, and green over the entire picture area. The effect of these is added together by the eye without perception of the individual dots as such. This method of photography, and others which depend on the addition of red, green, and blue light, are broadly termed "additive methods."

The second or "subtractive" method involves taking away from each point in the image amounts of the three primary colors which are not wanted. Three superimposed color layers exert independent control of red, green, and blue light. Their purpose is to absorb at each point of the image (assumed to be lighted by white light) those rays which the subject did not reflect. The color of each layer must therefore absorb the spectral rays transmitted by the corresponding taking filter. The subtractive method offers definite advantages in screen brightness and absence of pattern.

Independent control of red, green, and blue light requires three layers on the film. Each layer must control only the one primary color and let the other two primary colors pass freely.

Red light is controlled by a blue-green image which lets blue and green pass freely.

Blue light is controlled by a yellow image which passes green and red freely.

Green light is controlled by a magenta image which passes red and blue freely.

Subtractive color processes now in use differ principally in the manner in which the images of these three different colors are obtained and superimposed.

The Structure of Kodachrome Film

The film carries three emulsions on one face, separated by gelatin layers. The emulsion nearest the film base responds to red light, the middle emulsion to green, and that at the surface to blue. A yellow dye above the middle emulsion prevents blue light reaching the two lower emulsions, since these are also sensitive to blue, in addition to green and red respectively.

The layers, so thin that their total thickness scarcely exceeds that of the emulsion layer of a black-and-white film, are coated on safety film base having an antihalation backing.

Exposure of the Three Kodachrome Layers

The picture on the top emulsion is taken by blue light, on the middle emulsion by green, and on the bottom emulsion by red light. This is not accomplished by blue, green, and red filters, but in the following way: The top emulsion is sensitive to *blue* light only. The *green* and

the *red* light pass through it without affecting it, so that the *blue* light alone makes the exposure. The yellow dye (mentioned above) prevents any *blue* light from reaching the two lower emulsions. The middle emulsion is sensitive to *green* but not to *red*. It is sensitive to *blue* as all emulsions are, but the *blue* light cannot reach it, and the *red* light passes through without affecting it. Therefore, the exposure is made by *green* light. The bottom emulsion is sensitive to *red* but not to *green*. It is also sensitive to *blue*, but the *blue* light cannot reach it, and the *green* light does not affect it. Hence, the picture is taken by *red* light alone.

Two Types of Kodachrome Professional Film

1. Kodachrome Professional Film, Daylight Type, is color balanced for normal sunlight. This film is usable under other daylight conditions, as on overcast days, and in places lighted by blue sky alone. For such uses, compensating filters are provided, as described later.

2. Kodachrome Professional Film Type B is color balanced for tungsten lamps operating at such efficiency that the "color temperature" of the light is 3200° K. Color temperature is explained later. Lamps to give this light quality are available as described later on. This film can be used with Photoflood Lamps, preferably No. 2 or No. 4, and with Movieflood Lamps. Photoflash Lamps also are suitable in their color balance, when a filter (Wratten No. 2A) is used at the camera lens. This film is usable in daylight with the proper compensating filter (Wratten No. 85B).

Both types of film are described in detail in the specifications at the end of this chapter.

Handling the Film

Like black-and-white films, Kodachrome must be loaded with the emulsion facing the lens. Great care must be exercised to avoid touching the emulsion, because the removal of finger marks from Kodachrome is a more serious problem than from black-and-white film. The operator's hands must be absolutely free from grease and chemicals. The extreme edges may be handled since $\frac{3}{16}$ inch all around must be allowed for the processing holders. The film should be loaded in total darkness. Even a slight safelight fog on Kodachrome results in overall veiling of the same color as that of the safelight.

As with other Eastman professional films, when the identifying notches are on the top edge and at the right-hand side, the emulsion faces the operator.

Suitability of Camera Lenses for Color Work

In general, a lens must be more highly corrected for color work than for black-and-white to obtain the best possible result. It can be said, however, that any lens which gives critically sharp definition everywhere in the field (for panchromatic film with studio lighting) will be satisfactory for Kodachrome photography. This critically sharp definition must apply to the edges as well as the center of the picture. Soft definition at the edges may be due to one type of aberration known as transverse chromatic aberration which is very serious in color photography. If present, this results in images of different size, for the different colors of light. Thus the image by red light may be slightly larger than the blue-light image. As a consequence of this, near the edges of the picture, color fringes appear on any prominent edges of the subject. In black-and-white work the result of this is merely a slight softening of the definition. This transverse chromatic aberration should not be confused with axial aberration which is a difference in position of the images for various colors of light along the lens axis. In all good commercial lenses of today this effect is small and of no particular importance even in Kodachrome photography. The other aberration can be quite serious.

The following lenses are especially recommended for Kodachrome photography: The f:4.5, 101mm and the f:3.7, 105mm Kodak Ektar lenses for the 2¼ x 3¼ cameras; The Kodak f:4.7, 127mm Ektar lens for the 3¼ x 4¼ cameras (the filter and lens-hood attachments sizes for the first of these lenses is 1-9/32 inches or 32.5mm, and for the other two — 1½ inches or 38mm); The Kodak f:6.3, 14 inch Ektar is recommended for the 5 x 7 and 8 x 10 cameras.

Older photographic lenses, such as the Rapid Rectilinears, while they may be quite satisfactory for some types of black-and-white photography, will probably be unsatisfactory for Kodachrome photography. Moreover, any camera lens which is yellowish due to glass type, or other factor, may not be suitable, as a yellowish cast may result in the picture. Any lens used must be spotlessly clean and free from veiling. Kodak Lens Cleaner is recommended for lenses in need of cleaning.

Certain of the wide-angle lenses may show objectionable color fringing, and in some cases where the illumination drops greatly toward the corners of the picture the difference in the exposure of Kodachrome may be serious. With these reservations, any adjustments, such as rising front, and so forth, can be used for Kodachrome photography in just the same manner as for black-and-white photography.

The lens requirements for professional Kodachrome portraiture are not so exacting as for commercial photography. This applies especially to the head-and-shoulders portrait because the nature of the subject does not make color fringing, if present, quite so evident. It will, however, affect detail in hair and cloth. The best procedure in judging portrait lenses is to examine the image of a portrait subject on the ground glass with a magnifier and to make several actual portraits with the lens in question. For group photographs, the requirements are as critical as for commercial photography.

Lighting and Color Rendering In Outdoor Subjects

Perhaps the most important consideration in outdoor Kodachrome photography is the avoidance of excessive

contrast of lighting. This is accomplished by the use of reflectors to add to the illumination of shadows. While Kodachrome Film renders both highlights and shadows quite faithfully, the contrast of outdoor lighting introduces problems in reproduction of the transparencies, hence the desirability of lighting shadows with reflectors. Such reflectors should be fixed in position, rather than hand held.

A matte white reflector is not critical in the angle at which it is set but should be quite close to the subject to supply enough light. A specular reflector such as an aluminized sheet is more effective, but it must be placed accurately. This type of reflector can be used at a greater distance than a matte reflector, and is therefore recommended. The matte white reflector, when used for reflecting sunlight into the shadows, reflects a warmer light than is normal. Shadows are normally illuminated by light from the sky and light from surrounding objects. A light from an aluminized reflector is colder in color. Reflectors are generally necessary when side-lighted or back-lighted models are photographed outdoors.

When conditions demand a large aperture, the background should be chosen if possible to avoid scattered masses of color. This is particularly true of close-ups, where the background detail is decidedly out of focus. A flower bed, for example, is usually a poor background if it must be out of focus. A plain background is desirable in such cases.

Since the majority of outdoor pictures are made in sunlight, generally no filter is required for Kodachrome Professional Film Daylight Type.

There are many daylight conditions besides sunlight. The technique to be followed under these other conditions depends upon the effect which the photographer wishes to achieve. For example, when a scene is photographed, lighted by a very blue sky but shaded from the sun, photographs in Kodachrome with no filter will be bluish, that is, as it appears to the eye. But if the effect desired is that of diffused sunlight, that is, much warmer in tone, the Wratten No. 1 or No. 2A Filter should be used to give this effect.

Summary of Filters Recommended for Kodachrome Professional Film Daylight Type

Sunlight	No filter
Overcast sky	No filter or Wratten Filter No. 1
Shade (subject illuminated by diffuse skylight)	Wratten Filter No. 1 or No. 2A

No increased exposure need be given when the Wratten Filter No. 1 or No. 2A is used; in other words, their factor is 1.

A knowledge of these conditions, with an understanding that the color reproduction becomes increasingly warmer in changing from no filter to No. 1 and still warmer from No. 1 to No. 2A, enables the photographer to secure the effect he desires. A further factor which influences the desirability of the result is that a somewhat bluish cast gives the impression of a dull day. A yellowish or warmer hue gives the impression of a bright day. It is possible in some cases, therefore, to make photographs on an overcast day and yet produce the effect of warm, diffused sunlight with the use of the correct filter.

Very distant scenes, mountain views, high-altitude aerial shots, and other long-range daylight pictures in Kodachrome usually appear with a bluish overcast. This is natural and is to be expected, as the eye sees these views in the same way, even though mental allowance is made for the effect. The use of the Wratten No. 2A Filter reduces the bluishness somewhat in Kodachrome photographs.

Studio Lights Suitable for Kodachrome

Kodachrome Professional Film Type B is adjusted to give proper color reproduction when used with clear glass, high efficiency Mazda Lamps burning at a definite "color temperature" as explained later. Two important points about lamps for Kodachrome photography are the amount of light they emit and the color of this light. The amount of light emitted depends upon the wattage rating, the voltage rating, and increases rapidly as the voltage applied is increased. The color of the light is very important because on it depends the color rendering of the scene as a whole. If the color of the light is too yellow, a yellowish cast results; on the other hand, if the color of the light is too blue, the result bears a bluish cast. These conditions are more noticeable in the finished transparency than they are in viewing the actual scene. The correct color of light may be secured in one of two ways: 1, lamps as specified in the accompanying table, may be burned at exactly the intended voltage; 2, the color of the light of the lamps in use may be checked by the Eastman Color Temperature Meter and the voltage adjusted by a rheostat to secure the correct color; or if it is inconvenient to adjust the lamp voltage, the required compensating filter may be determined with this meter and applied to the camera lens.

The Color Temperature of Artificial Light Sources

If increasing voltage is applied to a lamp (by means of a rheostat, for example), the filament first becomes warm but does not glow and then successively glows dull red, red, and yellow. It then becomes increasingly "white," as it emits more and more blue light. During these color changes, the light intensity also increases. Color change is very important, since the film must be balanced for a definite color of light.

The system of rating the color of light is to state that the color of the light corresponds to that of a "black body" at a stated temperature, the temperature scale being measured in degrees Kelvin (°K) which are obtained by adding 273° to the corresponding tempera-

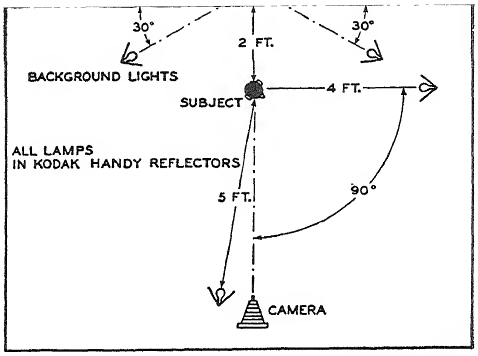
tures in degrees Centigrade. The lamp is said to have a "color temperature" which is equal to that of the actual temperature of the black body.

The color temperature of the lamps may be measured with the Eastman Color Temperature Meter.

Lamps for Kodachrome Photography

For the best results with Kodachrome Type B Film, Mazda Lamps 3200°K are especially recommended (and should be ordered by that name and operated at the rated voltage). Therefore, the photographer should find out what voltage is actually at the outlets and should specify the lamps accordingly. Stock voltage ratings are 110, 115, and 120. On special order at no extra charge, lamps for 100, 105, 125, and 130 volts are available.

The color temperature of these lamps when first used is slightly above 3200°K; at the end of their lives (at the burn-out point) the color temperature is slightly below



1. A suggested setup for Kodachrome portrait lighting 500-watt, 3200°K. lamp serves as main source of general illumination. Two No. 1 Photofloods placed individually on opposite sides. See text.

Lamps. No filter other than the color-compensating filters is recommended for use with Photoflood Lamps.

Any diffusers or reflectors used should be pure white to avoid changing the color of the light, unless special color effects are intended.

LAMPS FOR USE WITH TYPE B KODACHROME

Wattage	*Bulb*	*Volts*	*Base*	*Approx. Life (hrs.)*	*Burn*
5000	G-64, clear	110-115-120	Mog. Bipost	150	Base down
2000	G-48, clear	110-115-120	Mog. Bipost	60	"
2000	G-48, clear	110-115-120	Mog. Screw	60	"
2000	G-48, clear	110-115-120	Mog. Prefocused	60	"
1500	PS-52, clear	110-115-120	Mog. Screw	100	any
1000	PS-52, clear	110-115-120	Mog. Screw	75	"
1000	G-40, clear	110-115-120	Mog. Screw	35	Base down or horizontal
1000	T-20, clear	110-115-120	Mog. Screw	35	Base down
1000	T-20, clear	110-115-120	Mog. Prefocused	35	"
500	T-20, clear	110-115-120	Med. Screw	30	"
500	T-20, clear	110-115-120	Med. Prefocused	30	"
500	A-25, inside frosted	110-115-120	Med. Screw	20	any

3200°K. For practical purposes they may be considered at 3200°K irrespective of age, especially if several such lamps of varying ages are used together. The performance of these lamps in use may be checked by the Eastman Color Temperature Meter.

Of the 3200°K Mazda Lamps designed primarily for this film, the one best suited for photography at home is the 500-watt size, which has a 20-hour life rating. Since it has the same bulb size and base as the No. 2 Photoflood Lamp, it is readily usable in amateur lighting.

While Mazda Lamps 3200°K are to be preferred to other types, the Mazda Photoflood Lamps can be used. No. 1 Photoflood Lamps burn initially at about 3400°K and are, therefore, bluish compared to the 3200°K lamps. No. 2 and No. 4 Photoflood Lamps and Movieflood Lamps burn at a lower color temperature than the No. 1 lamps and are therefore preferable to the No. 1

Summary of Filters Recommended for Kodachrome Professional Film Type B

Studio Lighting (Mazda Lamps, 3200°K)	No filter
Movieflood Lamps	No filter
Photoflood Lamps	No filter
No. 21 Mazda and other leaf-foil Photoflash Lamps	Eastman CC15 Filter
Sunlight	Wratten Filter No. 85B
Kodatron Speed Lamp	Eastman Color Compensating Filter CC15
White Mazda Fluorescent Lamps	Eastman CC25 and CC34 Filters

Use of the Eastman Color Temperature Meter

The Eastman Color Temperature Meter is specially designed to permit control of the quality of illumination to obtain proper color balance in the final color photograph. To read the color temperature of a lamp, the user points the instrument at the lamp and looks into the eyepiece to see a two-part field. The two parts of the field

differ from each other in color until the instrument is adjusted to attain the same color in both halves. The dial of the instrument reads directly in the color temperature of the lamp. The lamp itself is not visible in the meter. In measuring the color temperature of very strong light sources such as studio lamps, the field may be too bright to permit an accurate reading. The Eastman Color Temperature Test Paper, provided with the meter, is held in the full beam of the light, the Color Temperature Meter directed toward it, and the reflected light read and interpreted according to the meter instruction book. With a certain amount of practice, the photographer, not otherwise experienced in photometric measurements, will be able to determine the color temperatures to closer than 50°K. This is sufficiently precise for practical purposes, because it is not possible generally to detect differences of less than 100°K by changes in the general balance of the final color picture.

When the color temperature has been measured, it may be found to be different from that for which the film is balanced. It will be necessary, therefore, to compensate for this if a well balanced color picture is to be obtained. The most satisfactory way of compensating for the color temperature difference is to change the voltage on the lamps until the correct color temperature is obtained. If the lamps are of similar type and wattage, and of roughly equal age and if the voltage drops in the leads are approximately equal, this can be done by using a single rheostat at the switchboard. In extreme cases, it may be necessary to use voltage control units in leads to some individual lamps.

If voltage control is not possible, compensation can be effected by using the Eastman Color Compensating Filters at the camera lens. These are supplied in sets of seven, four of them bluish in color for increasing the color temperature, and three yellowish for reducing it.

The Eastman Color Temperature Meter is only slightly larger than the usual pocket exposure meter and requires no batteries or other power supply. Full particulars for the use and interpretation of the results of the instrument are given in the booklet which accompanies it.

Procedure in Lighting

Lighting is built up in the manner usual with black-and-white photography with the reservation that the illumination must be quite uniform and the brightness range must be lower than for black-and-white photography. The general floodlighting should be applied first. Additional lights should be added from various directions to achieve the emphasis desired. One or more lights should be placed in a low position to illuminate the shadows which result from the lights previously applied. Deep shadows must be avoided unless black rendering is intended.

While the experienced color photographer can easily achieve this quality of uniform illumination and the required lighting contrast by inspection, the use of a photoelectric exposure meter for scanning the subject is helpful to those not so experienced. The Weston Electrical Instrument Corporation suggests that, when their exposure meter is used, the readings for various parts of the subject should fall within a range of 4:1 to obtain proper exposure tolerance. Thus this figure does *not* represent film latitude.

Portrait Lighting

Kodachrome portrait lighting requires several light sources. A suggested arangement calls for a 500-watt 3200°K lamp in a Kodak Handy Reflector which serves as a source of general illumination. The unit should be mounted on a Kodaflector stand or similar base. Two lamps should be placed individually on opposite sides of the subject to illuminate and bring out the colors of the background, and to fill in the background shadows caused by the subject's head. Another 500-watt 3200°K lamp in a Kodak Handy Reflector should be placed at a distance of 4 feet from the subject to give it form. These sources of illumination should be arranged as shown in the diagram, Figure 1, which is for a closeup of a three-quarter face. The proper exposure should be about 1/5 second at f:4.5 or 5 seconds at f:22 for Kodachrome Professional Film Type B. The setup may be used also for a full face close-up by having the subject turn his head directly toward the camera and by moving the light on the right to a position halfway between its former position and the camera (on the arc).

Modification of these arrangements makes the lighting suitable for a number of various types of arrangements, leading to attractive Kodachrome pictures. The photographer's ingenuity will suggest other setups.

2. PORTRAIT by Thomas Welles. 4 x 5 Speed Graphic, 1/10 second, f:11, Fast Pan film. Two lights were used; the main front light was 1000-watt Mazda in reflector . . . for the highlighting a No. 2 Photoflood in a Victor reflector.

The setups in the accompanying illustration should not be attempted with four 500-watt lamps on house electrical circuits wired for only 15 amperes capacity, since the load is almost certain to blow fuses. However, if there are two 15-ampere circuits in the room, two 500-watt lamps may be used on each. It must be remembered that the main house fuse is usually for 30 amperes, so the total load must not exceed this.

The Kodak Handy Reflector is mentioned merely to afford some definite exposure data. Naturally, other neutral reflectors can be used.

In portrait lighting, the photographer must be reminded that blue glass lamps cannot be used with Kodachrome Professional Film Type B. While the use of blue glass lamps is quite usual in black-and-white photography for modeling work, such lamps are unsuitable and cause a blue rendering of the face. *Clear glass* (not blue glass), 3200°K lamps should be used in the general lighting, modeling lights, and for other purposes. Any diffusers or reflectors used should also be white, not bluish or yellowish. Another important point is that the light must be studied very carefully and arranged when possible to conceal defects which would otherwise have to be retouched out. Retouching must be regarded as impractical for Kodachrome transparencies. Retouching can be done only in color printing or in reproduction from Kodachrome.

Make-Up for Kodachrome Photography

For a number of years, photographic illustrators have utilized make-up to enable them to produce both proofs and finished prints quickly, so as to minimize retouching which might change or destroy expression. Like cinematographers, who use make-up because it is impractical to retouch cine films, illustrators have wanted their unretouched negatives to yield perfect proofs and prints. Similarly, make-up is desirable in portraiture and in other close-up work with Kodachrome, because the Kodachrome transparency should be as nearly perfect as possible.

The "panchromatic" make-up materials developed for black-and-white photography, however, are not all suitable for color photography. "Pan" make-up is designed to accommodate the color sensitivity of fast panchromatic negative materials. Make-up for color photography is designed to enhance natural coloring and beauty. If color make-up is properly applied, the Kodachrome transparency will show no evidence of its use.

The successful application of color make-up requires careful work and a little experience, but it is not especially difficult. The necessary materials and general procedure are outlined here in general.

Make-Up for Women

MAX FACTOR

Complexion Type	*Foundation*	*Powder*	*Eye Shadow*	*Lip Rouge*	*Eyebrow Pencil*	*Eyelash Make-up*	*Cheek Rouge*
Blonde	Pan-Cake Cream No. 1 or 2	Olive No. 1	Light Brown	Tru-Color Light Red	Light Brown	Brown	Light Red
Sun Tan	Pan-Cake Tan 1 or Natural 2	Sun Tan	Brown	Tru-Color Medium Red	Brown or black	Brown or black	Tru-Color Dark Red
Brunette	Pan-Cake Natural 1 or 2	Olive No. 1	Brown	Tru-Color Medium Red	Brown or black	Brown or black	Tru-Color Dark Red

MINER, INC.

Complexion Type	*Foundation*	*Powder*	*Eye Shadow*	*Lip Rouge*	*Brown Pencil*	*Cheek Rouge*
Fair	K-22	K-22	Foto No. 1	K-Light	Brown	Medium
Brunette	K-23	K-23	Foto No. 2	K-Medium	Brown	Medium
Suntan	K-25	K-25	Foto No. 2	K-Dark	Brown	Medium

RUBINSTEIN'S PHOTOCHROME

Foundation	*Powder*	*Eye Shadow*	*Lip Rouge*	*Eyebrow Pencil*	*Cheek Rouge*
Photochrome No. 1	Light	Light Brown	Medium Red	Brown	Medium

Materials for Color Make-Up

The following are fundamental materials for color make-up:

Foundation	Rouge	Brush for Liner
Face Powder	Eye Shadow	Towels
Powder Brush	Eyebrow Pencil	Face Tissue
Lip Rouge	Liner	Cold Cream
Brush for Lip Rouge		

These materials are available from several manufacturers, and preference between the products offered is a matter of personal choice. A partial listing of suitable materials is offered on pages 100 and 101.

Max Factor's Pan-Cakes are in dry cake form, and are applied with a moist sponge in a thin, even coat. Although primarily intended for street make-up, they are very good for color photography.

Miner, Inc., foundations are of the grease-paint type. This company supplies a complete make-up kit through photographic dealers.

Helena Rubinstein's Photochrome foundation is supplied in liquid form. It is easily applied, dries evenly, and yields fine skin texture.

Elizabeth Arden's Screen-Stage Make-up, particularly the "N" Technicolor Series, is easy to apply, and is widely used.

Make-Up for Men

MAX FACTOR

Foundation	*Powder*	*Eyebrow Pencil*
Pan-Cake Tan No. 1	Sun Tan	Brown or Black

MINER, INC.

Complexion Type	*Foundation*	*Powder*	*Eyebrow Pencil*
Fair	K-23	K-23	Brown
Medium or Dark	K-24	K-24	Brown

RUBINSTEIN'S PHOTOCHROME

Foundation	*Powder*	*Eyebrow Pencil*
Photochrome No. 2	Medium	Brown

Applying Make-Up

Cleanliness is a paramount rule. The table holding the materials should be kept clean and neat; plenty of towels should be available; the model's clothing and hair should be protected with a large cloth and a towel; and the operator should wear a clean smock. The operator should wash his hands thoroughly before starting, and wipe them clean between steps. Brushes should be washed and sterilized after using. A few states have laws governing sanitary conditions for this work.

A convenient and effective method of working is for the model to sit in front of a large, well-lighted mirror, in which the operator can check his progress at intervals. The first step is to ask the model to remove all street make-up, preferably with soap and water.

Foundation. The foundation is applied first, according to instructions for the particular type of foundation being used. It should be used sparingly, but worked thoroughly into the face to effect a complete, even covering. It must be blended into the hairline, and from face to neck, so as to show no hard lines. Excess foundation can be worked off the face with the fingers, by wiping the hands frequently. Skin blemishes which show through the foundation will largely disappear when the powder is applied.

Cheek Rouge. The application of rouge requires experience and judgment, and is sometimes done best by the model herself. Rouge should usually follow the contour of the cheekbone, and must be carefully blended into the foundation to avoid an unnatural spot of color. In make-up for color photography, rouge can be slightly heavier than for street wear.

The Eyes require careful attention, for they are the most expressive part of a portrait. Normal eyes are emphasized if a small amount of eye shadow, first spread thin in the palm of the hand, is applied to the upper lid, beginning at the inner corner and continuing to the outer corner. The shadow should be heaviest at the edge of the lid, and should blend gradually upward. A slight touch of cold cream on eyelids produces attractive highlights, and adds to the brilliance and expression of the eyes. Deep-set eyes may require no make-up, or extremely light make-up. Prominent eyes can often be improved in appearance with an eye shadow slightly darker than normal.

Powder. A generous quantity of powder in the proper shade should be pressed, not rubbed, into the foundation with a clean powder puff. After the face is thoroughly covered, excess powder is dusted off by gentle strokes of the powder brush.

The Lips. Lip rouge is best applied with a brush. To retain the natural shape and symmetry of the mouth, the upper lip is made up first, the lips are pressed together, and the outline of the upper lip on the lower is filled in carefully.

Eyebrows and Eyelashes. The natural line of the eyebrows should be slightly emphasized with a brown or black pencil. Lashes should be touched lightly with mascara; this can be done by the model herself.

Corrective Treatment

With study and experience, make-up can be employed to improve the appearance of a prominent forehead, closely or widely spaced eyes, a short or long nose, and other faults. Such treatment is most effective in photographs of the full face; it has no effect in portraits showing the profile. For instructions, the reader is urged to consult other more complete discussions of make-up technique.

Removing Make-Up

A successful make-up for Kodachrome should look so natural that a woman would usually prefer to wear it rather than have it removed. When necessary, however, grease-paint foundations can be removed with several applications of cold cream; liquid and cake foundations, with soap and water. A good skin lotion should then be applied to soothe and relieve any slight irritation.

Make-Up for Men

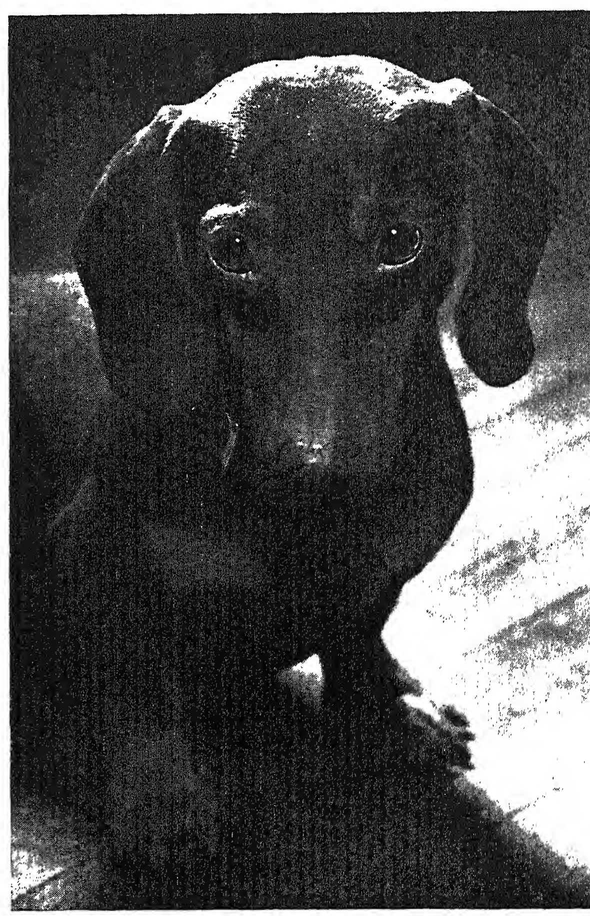
Men often object to being made up for a portrait sitting; therefore it is fortunate that less make-up is required for men than for women. The most important single point to be observed here is that a man *must* be closely shaved a short time before his picture is taken with Kodachrome. Even a slight beard will show in the Kodachrome transparency, unless covered by a heavy, unnatural make-up. Beyond this precaution, a partial make-up of powder only will be sufficient for nearly all subjects having a smooth skin of normal color.

More complete make-up for men is usually required in illustrative photography, and occasionally in portraiture. When it is used, the general technique is the same as for women, except that no eye shadow or cheek rouge should be used, and no lip rouge unless the lips are extremely weak. Powder should be applied last, to reduce the prominence of heavy eyebrows and lip rouge, if lip rouge is used. The primary object of the make-up is to cover noticeable blemishes and give the skin a natural, healthy appearance, although corrective treatment can be applied if necessary.

A useful correction for men is the technique of reducing flesh under the jaw by the use of a foundation two shades darker than that used on the face. The darker foundation produces the effect of a shadow depressing the flesh. Reflections from bald heads should be controlled with a head screen—and the head not subjected to make-up.

Studio Backgrounds and Drapes

Backgrounds, drapes, and costumes assume a new importance in Kodachrome photography not considered in black-and-white photography. A colored background or drape, if close to the subject, reflects light of its own color onto the subject. Thus an orange background may tinge the far side of the subject with an orange hue. Likewise, a colored drape close to the subject, but just out of the picture field, may cause a noticeable tint on one side of the subject. To avoid such effects, backgrounds should be placed six or more feet behind the subject. This requires individual lighting on the background. The color in which the background appears in the picture depends greatly on the extent to which it is lighted; for example, a yellow background which has insufficient light on it may appear tan or even dark brown. If the background is to record in the way it appears to the eye, it must have the correct amount of illumination on it as related to the subject. This can be determined readily with the photoelectric exposure meter. In any case the brightness of the background should be within the range previously mentioned for proper contrast. All other colored backgrounds or drapes on the set should be removed some distance from the subject.



3. Back and front lighting gave Torkel Korling a chance to make this excellent dog portrait. Synchroflashed with 4 x 5 Graflex camera.

Photoflash Technique

While the speed of Kodachrome Professional Film renders it superior to other color media with tungsten lamps, the use of Photoflash Lamps is advantageous in several situations which offer lighting problems. When the work requires that models pose under full illumination for a number of pictures over a considerable time, the use of Photoflash Lamps is preferable in conserving both the appearance and energy of the models. An application of considerable importance is that of close-ups of a type which requires great depth of field, hence very small lens openings. The required illumination is intense and may be achieved most readily with Photoflash Lamps.

Perhaps the most important problem in working with Photoflash Lamps is that the lighting cannot be studied beforehand, except by the use of pilot tungsten lamps. There are lighting units available to take both tungsten and Photoflash Lamps, and their use is therefore desirable. The tungsten lamp is used in arranging the lighting, and the exposure is made with the Photoflash Lamps. To secure the same lighting effect from the Photoflash Lamps, the same ratio of tungsten lamps to Photoflash Lamps must be observed in each lighting unit. For this reason, all the tungsten lamps (Photoflood or other) must be the same wattage, and all the Photoflash Lamps must be the same size.

If a trial exposure is necessary, a lens aperture 1½ stops smaller, with the intended number of Photoflash Lamps, may be used for an exposure on Eastman Portrait Panchromatic Film.

The most desirable exposure technique with Photoflash Lamps in Kodachrome photography is to employ the whole flash, that is, the shutter is opened, all the lamps are fired on the same circuit, and the shutter is closed. This results in an effective exposure time of about 1/50 second. If the subject is in motion and requires a shorter exposure, a synchronizer is necessary.

Good synchronizers are now readily available for between-the-lens shutters. The Graflex Flash Synchronizer and the Kodak Senior Synchronizer are among those available. Some of the Graphic focal plane shutters are equipped with built-in contacts for use with the Graflex Flash Synchronizer. Some of the older Graphics not so equipped can be fitted with synchronizer contacts by the Folmer Graflex Corporation. Further details on this subject will be found in the chapter "Synchroflash Photography" elsewhere in this volume.

For synchroflash exposures on Kodachrome Professional Film Type B when the focal plane synchronizer is used, the flash lamps designed especially for focal plane shutters must be used, except when exposures of 1/5 sec. are employed. Flash lamps recommended specifically for use with focal plane shutters are: Mazda No. 31 and No. 6 and Wabash Superflash No. 2A. Exposure data on these flash lamps are given in the chapter on "Synchroflash Photography".

Kodachrome Type B Film with the Wratten Filter No. 2A must be used for all Photoflash exposures where no daylight is present. When daylight is present and a flash is needed for supplementary illumination, indoors or out, the Mazda No. 21B lamp is recommended.

To Illuminate Shadows in Outdoor Subjects

SYNCHRONIZED OUTDOOR FLASH PICTURES WITH 21B PHOTOFLASH LAMPS AND KODACHROME PROFESSIONAL FILM DAYLIGHT TYPE

LAMP-TO-SUBJECT	SHUTTER SPEED	LENS OPENING
5 ft.	1/25	*f*/8
7 ft.	1/50	*f*/5.6
10 ft.	1/100	*f*/4

The above table is based on practical tests on average subjects in bright sunlight. As the distance from lamp to subject increases, the lens opening must be increased. This, in turn, demands a corresponding increase in shutter speed to expose correctly the sunlit portions of the subject. This change in shutter speed does not affect the flash exposure proportionally, because the highest intensity in the flash persists for a very short time. Because of diversities in equipment and weather conditions the table above is offered only as a guide. Individual modifications will probably be necessary.

Exposure Determination

The exposure determinations for color photography must be carried out much more precisely than for black-and-white photography. Judging exposure by the brightness of the ground glass image is *not* satisfactory. Several methods are suggested here for arriving at the correct exposure, but it must be emphasized that it is of no avail to determine exposure precisely if the shutter mechanism is not exact.

If your camera has been in use for a number of years, it would be well to have the shutter checked. For time exposures, the lighting and lens opening should be so arranged that the exposure time comes between two and ten seconds, and a stop watch should be used. When the exposure recommendations on the instructions packed with the film differ from the exposures given below, the former should be followed.

For nearby subjects, it is quite important to allow for the change in effective f/ value due to the increased distance between the lens and film.

$$\text{Effective f/ value} = \frac{\text{Indicated f/ value x lens-to-film distance}}{\text{focal length}}$$

The lens-to-film distance is the focal length plus the lens

extension from its position for infinity focus. Thus, for a 7-inch lens working at a lens-to-film distance of $8\frac{1}{2}$ inches, the effective aperture for an indicated aperture of f/16 is

$$\frac{16 \times 8\frac{1}{2}}{7} = \text{approximately } f/22$$

These computations can be made rapidly with the "Relative Lens Aperture Kodaguide", a dial calculator of inestimable value, available through Kodak dealers.

A. Basic Sunlight Exposure

The basic exposure for normal subjects in full sunlight is 1/50 second at f/6.3. This is subject to modification by weather conditions, and by hourly and seasonal variations.

B. Substitution Method, in the Studio

For studio work, a series of test exposures can be made on Eastman Portrait Panchromatic Film. These exposures should differ from each other by one stop. These films should be developed with vigorous agitation in a tray of DK-50 for exactly $3\frac{1}{2}$ minutes, at 65° F. The negatives should be examined critically. From these negatives the exposure for Kodachrome may be derived. The exposure so derived must not be regarded as exact because it is principally *shadow detail* which determines correctness of exposure for a negative, whereas *highlight detail* is probably more important in a reversal positive such as Kodachrome.

The relation between exposures for highlights and shadows is not a fixed value; it depends on the brightness range of the subject. For this reason, the relation between the exposures required for Eastman Portrait Panchromatic Film and Kodachrome Film is a variable one—Kodachrome requires about three times that for Eastman Portrait Panchromatic Film. The test negatives should be kept and compared with the Kodachrome transparency. From such a study, a guide of exposure can be established for using Eastman Portrait Panchromatic Film to insure correct exposure on Kodachrome Professional Film.

It must be remembered that the exposure tolerance of Kodachrome is less than that of black-and-white negative film, and, consequently, test exposures on black-and-white material must be examined judiciously. It must also be kept in mind that highlight detail is probably more important than shadow detail in Kodachrome Film.

C. Exposure Series Method

For subjects under unusual lighting conditions, and especially when circumstances make retakes inconvenient, it is urged that a series of exposures be made differing from each other by a factor of one-half stop. Extra film cost is small compared with retaking expense.

D. The Use of Photoelectric Meters

A reliable photoelectric meter can be used to advantage. While the exact meter rating to be used depends on the method of manipulating the meter and its calibration, it is suggested that the following ratings be used as a guide:

	For Weston Meter		*For General Electric Meters*	
Film	*Daylight*	*Tungsten*	*Daylight*	*Tungsten*
Daylight Type	10	..	16	..
Type B . .	4*	6	6*	10

*Exposed through Wratten Filter No. 85B.

As mentioned under "Lighting" it is suggested that the subject be scanned closely with the meter and a representative meter reading taken for computing the exposure.

A photoelectric meter may be applied to small-object photography as follows: An Eastman photographic paper envelope should be put in front of the object to be photographed, facing the camera. A reading should be made by holding the meter close to the envelope without shading it. For average subjects (neither very light nor very dark), the indicated exposure should be doubled.

Meters which read a very wide angle, if used at the camera position, tend to make errors on the overexposure side in the studio, and on the underexposure side outdoors.

E. Checking the Meter and Camera in the Studio

For Kodachrome photography, a photoelectric exposure meter must be accurate. If the need for recalibration is indicated, it should be returned to the makers for calibration, with a statement of the purpose for which the meter is to be used.

The best possible calibration of the meter is a photographic one—a series of exposures should be made on Kodachrome Professional Film Type B, differing by half a stop, on a studio subject which is typical of the subject matter to be handled. Meter readings should be made both for the set as a whole and for any important details of it. These readings should be compared with the Kodachrome transparencies after their return from processing. From this comparison a meter rating can be selected which gives best results and should be used for future work. This calibration is the most practical because it considers lens and shutter factors as well as those of the meter, and individual working conditions.

F. Checking the Meter and Camera in Daylight

The high end of the scale may be checked in daylight by using the meter on ordinary scenes and comparing the exposures it indicates with the photographs actually obtained from a series of exposures. This should be done for a number of scenes, preferably in full sunlight. The basic exposure for normal sunlit subjects is 1/50 at f/6.3.

If the meter shows a deviation greater than a factor of two times from the film speed as given by the manufacturer of the meter, it may be well to return the meter to the manufacturer for recalibration.

Incidentally, it is possible for a meter to be correct in the upper part of the scale and incorrect in the lower, or vice versa. The reading at the lower end is quite sensitive to incorrect zero setting, that is, to the needle position for no deflection.

Returning Films for Processing

At present, Kodachrome Professional Film is processed in Rochester, N. Y., only. After the film has been exposed, it should be wrapped in the material in which it was received, with care to interleave the exposed films with sheets of black paper supplied with each box of Kodachrome Professional Film. ***The film should be returned in the box in which it was originally packed with the return gummed label attached to the outside cover. The sender's name and address should be printed plainly in the space provided for this purpose. There is no other means of identifying the returned film. The package should be tied securely before being mailed, and if the package is sealed, first-class postage must be paid.***

When exposed film is returned for processing in packages of three sheets or more at one time, no service charge is made for processing; but when fewer than three sheets are returned in one package, a service charge of 50 cents a package is made to cover the additional cost of handling film returned in this manner. An envelope in which stamps may be placed to cover this charge is supplied with each package of film. Stamps are preferable to coins, as there is possibility of the metal abrading the film, should the package be subjected to rough treatment.

Processed Kodachrome Films will be mailed whenever possible within 48 hours of their receipt unless they are received late Friday, Saturday, or on holidays. Time in transit can be considerably reduced by sending the film by first-class mail, special delivery, air mail special delivery, or by air express which is actually the fastest service, with no P.O. delays. If it is desired to have the film returned by first-class mail, or air mail, or air express, such should be specified and the necessary postage provided. Any writing or instructions included in the package subject it to the first-class mail rate. Writing or instructions may, of course, be included in packages sent by first-class mail or air mail.

Handling and Viewing Kodachrome Transparencies

Kodachrome transparencies are returned to the photographer in sleeves of clear Kodapak to prevent finger marks and scratches. The transparencies should be kept in these sleeves except when separation negatives are being made. Finger marks made on processed film can be removed partly with a soft cloth slightly moistened with pure carbon tetrachloride, or with Kodak Ciné-Film Cleaner. Finger marks which have occurred in loading or unloading the film cannot be removed.

Kodachrome Viewing Folders for showing and viewing Kodachrome transparencies, in sizes 4 x 5, 5 x 7, and 8 x 10, are available and should be ordered by size. The folder consists of a cover and back with a center section for the transparency. The color balance of all Kodachrome Film is so adjusted that, when the transparencies are viewed by tungsten light, the color appears correct. We recommend the use of a Kodachrome Illuminator, 8 x 10. If the transparency is viewed by daylight rather than by tungsten light, it appears too blue.

Processed Kodachrome Film should be stored where it is kept dark, dry, and cool, away from radiator steam-

5. Photographs of dogs always make appealing pictures. A two-bulb synchroflash photograph by Torkel Korling.

pipes, or locations where it may be subjected to high temperatures. Under no circumstances should Kodachrome be purposely humidified. Extreme humidity in some cases has resulted in brownish discoloration.

Character of Kodachrome Most Suitable for Reproduction

Transparencies made from Kodachrome Professional Film are generally used for reproduction, whereas transparencies from miniature Kodachrome Film are usually projected and are therefore necessarily highly transparent for a brilliant screen image. The lighting contrast of Kodachrome Professional Film should not be too great, good modeling must be procured in the highlights, and the density can be greater than that of miniature Kodachrome. A little experience soon indicates how the most suitable Kodachrome originals may be obtained. To summarize, as compared with Kodachrome for projection, Kodachrome for best reproduction should appear less exposed and somewhat flat in subject contrast.

Kodachrome Duplicates

The Eastman Kodak Company is prepared to make enlarged Kodachrome transparencies in any size, up to and including 11 x 14 inches, from original K828 Bantam and

K135 Retina Kodachrome transparencies, and from Kodachrome Professional transparencies, 5 x 7 inches or smaller. (Kodachrome enlargements 11 x 14 inches are not supplied from 8 x 10-inch Kodachrome.) The Company is also prepared to make reductions in Kodachrome to any smaller size (5 x 7 inches or smaller) from any Kodachrome Professional transparency. When reductions are made from any of the larger sizes to 35 mm, the K135 Retina size will be supplied. No reductions smaller than 24 x 36 mm are available. Kodachrome duplicates (the same size as the original) are available from all Kodachrome transparencies (except 11 x 14 inches). When duplicates are made from K828 Bantam size, they will be supplied in the K135 Retina size. No duplicates are furnished from stereo Kodachrome or from Kodachrome transparencies smaller than K135 Retina (24 x 36 mm).

Kodachrome for Standard-Sized Lantern Slides

It should be remembered in making standard-sized slides (3¼ x 4 inches) that the standard lantern slide mask size for theater use is 2¼ x 3 inches. Some projectors show an area larger than this. The most suitable sizes for Kodachrome pictures for standard-sized slides are 2¼ x 3¼ inches, or 3¼ x 4¼ inches. Naturally, sections may be cut from larger sizes *after processing.*

The Kodachrome transparency and its mask may be bound between two lantern slide cover glasses. It will aid in registering the desired portion of the Kodachrome to trim the Kodachrome to standard lantern slide size, which is 3¼ x 4 inches.

After the Kodachrome transparency is bound, a small gummed sticker is added to the slide at the bottom left-hand corner so the subject appears correct when the sticker faces the operator. This sticker is a "thumb marker" for the projectionist.

The character of Kodachrome suitable for this purpose is rather more transparent than the most suitable Kodachrome for reproduction, and the contrast can be greater.

The chief advantages of Kodachrome lantern slides over those made by other color processes are greater screen brightness and absence of pattern; and special projectors are not required. Kodachrome, like all color transparencies, should not be left unduly long in the projector unless it is equipped with a water cell or other efficient cooling device.

SPECIFICATIONS—Kodachrome Professional Film Type B

General Properties: A color film in sheet form especially suited for use with high-efficiency tungsten lamps burning at 3200° Kelvin, yielding full-color transparencies of high quality. Photoflood Lamps may also be used for light sources. The transparencies may be viewed by transmitted light, or may be projected, and are highly suited to photomechanical reproduction. Color prints by the Eastman Wash-Off Relief Process and other processes are also possible, and black-and-white prints can be made with the aid of an intermediate negative. Duplicates can be made according to the information already given.

Film Sizes Available:

2¼ x 3¼ in.	5 x 7 in.	6.5 x 9 cm.	4.5 x 10.7 cm.
2½ x 3½ in.	8 x 10 in.	9 x 12 cm.	6 x 13 cm.
3¼ x 4¼ in.	11 x 14 in.		
4 x 5 in.			

For all cameras accommodating sheet film in these sizes.

Recommended Meter Settings:

Professional Kodachrome Type B	Weston Setting	G. E. Setting
Daylight	4*	6*
Tungsten	6	10

*With Wratten No. 85B Filter

Filters and Purposes:

Filter	Purpose
Eastman CC15	To be used with No. 21 Mazda and other leaf-foil Photoflash Lamps.
Wratten No. 85B	Permits use of this film in daylight.
Eastman CC15	Compensating Filter for Kodatron Speedlamp.
Eastman CC33	Compensating Filter for Daylight Fluorescent Lamps.
Eastman CC23 and CC43	Compensating Filter Combination for White Flame Carbon Arc Lamps.

Exposure Table—3200° K. Lamps: Basic Exposure Table for Kodachrome Professional Film Type B with 2 500-W. A-25 3200° K. Mazda Lamps in Kodak Handy Reflectors (or other Reflectors of Comparable Efficiency).

Distance Lamps to Subject	Diaphragm Opening at 1 Second Exposure
6 ft.	f/8
8 ft.	f/5.6
12 ft.	f/3.5
17 ft.	f/2.8

This table is for average-colored subjects.

For dark-colored subjects give ½ diaphragm opening more exposure.

For light-colored subjects give ½ diaphragm opening less exposure.

SPECIFICATIONS—Kodachrome Professional Film Daylight Type

General Properties: A color film in sheet form for outdoor use, yielding full-color transparencies of high quality. These may be viewed by transmitted light, or projected, and are highly suited to photomechanical reproduction. Color prints by the Eastman Wash-Off Relief Process and other processes

can be made from Kodachrome Professional Film transparencies. Black-and-white prints can be made by means of an intermediate negative. Duplicates can be made according to the information previously given.

SPECIFICATIONS — *Kodachrome Professional Film Daylight Type . . . continued*

Film Sizes Available:

$2\frac{1}{4} \times 3\frac{1}{4}$ in.	5 x 7 in.	6.5 x 9 cm.	4.5 x 10.7 cm.
$2\frac{1}{2} \times 3\frac{1}{2}$ in.	8 x 10 in.	9 x 12 cm.	6 x 13 cm.
$3\frac{1}{4} \times 4\frac{1}{4}$ in.	11 x 14 in.		
4 x 5 in.			

Recommended Meter Settings:

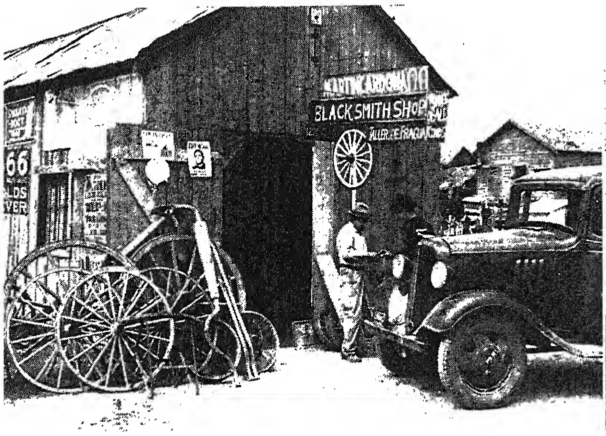
Professional Kodachrome Daylight Type	Weston Setting	G. E. Setting
Daylight	10	16

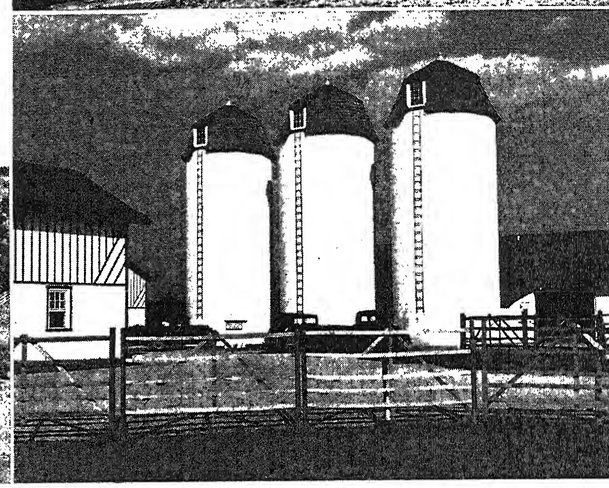
Filters and Purposes:

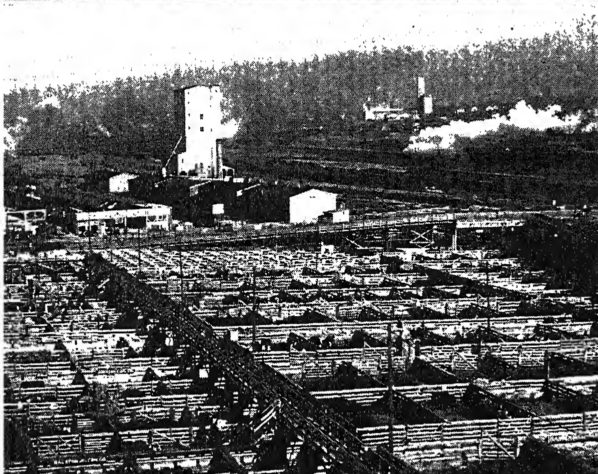
Filter	Purpose
Wratten No. 1	Gives improved rendering with overcast sky.
Wratten No. 2A	Gives improved rendering to subject in shade, illuminated by blue skylight.

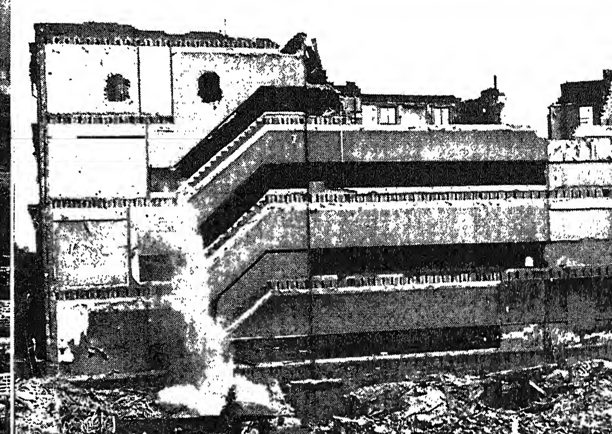
Daylight Exposure Table: Kodachrome Professional Film Daylight Type. Lens Apertures at 1/50 Second Shutter Speed.

Lighting	Basic Exposures for Average Subjects	Light-Colored Subjects	Dark-Colored Subjects	Side-Lighted Subjects	Back-Lighted Subjects
Bright, Direct Sunlight	Between f/8 and f/11	f/11	f/8	f/6.3	f/4.5
Weak, Hazy Sun, No Distinct Shadows Cast	f/6.3	f/8	f/5.6		
Sky Overcast, Cloudy, but Bright, Open Shade on Bright Day	f/4.5	f/5.6	f/4		
In Shade on Bright Day	f/3.5	f/4	f/2.8		









FARM SECURITY ADMINISTRATION PHOTOGRAPHS cover some of the most significant and valuable educational subjects in the United States. The above six pictures give only a very small sample of the thousands of excellent photographs available in this important federal government department. Photos by Post and Vachon.

A. Blacksmith shop, San Antonio, Texas.
B. Rich farm land, York County, Penn.
C. Stockyards in Omaha, Nebraska.
D. Old Southern home built in 1850.
E. Barn and silos, York County, Penn.
F. How a building is torn down.

MODERN EDUCATIONAL PHOTOGRAPHY

S. B. ZISMAN

We must not think of education in the narrow sense of classroom instruction but rather as an experience in which we learn about ourselves and our environment. Learning is not confined to textbooks and school buildings. It takes place while we work, when we talk with our friends, when we go to the movies, when we dig into our newspapers and magazines. We are being taught not only by the patient schoolmarm at the blackboard, but by our fellow workers, our writers, and our photographers as well.

This view of education is of importance to every photographer. He should realize that fundamentally he and the classroom teacher have the same end in view: both are trying to convey some information, some fact or story, some telling mood or emotion. Each aims to interpret for others what he has himself seen and understood.

The classroom teacher has already started to make use of the work of the photographer and stands to gain much from learning something of the photographer's craft. In turn the photographer can learn much from the technique of the professional teacher so that his own work will gain in scope and power. He can observe that a good teacher selects significant material but may use even the most commonplace material of his immediate environment. He organizes this material and its presentation so that the student gains fresh experience in the quickest and most direct way possible. He dramatizes his material, highlighting major points, making pertinent details clear and distinct. He teaches one thing at a time. He eliminates non-essentials and avoids confusion. He makes the subject meaningful and interesting by relating it to the student's experience and considers how the student will view it. He chooses appropriate tools and learns how to use them, not for the sake of the tool, but for the sake of the subject. These are specifications for good teaching; they are also specifications for good photography.

The photographer can perceive *first,* that his pictures inform people as well as please them; *second,* that often his pictures will gain in effectiveness, interest, and worth if he understands this educational aspect of photography and exploits it honestly; and *third,* that along these lines he can open for himself new vistas of photographic expression, new opportunities and outlets for his camera work. The visual techniques that may be used in school can be applied in the educational department of a manufacturing company or in the educational work of a labor union. They may be used to instruct a group of salesmen who may in turn use them in selling. Pictures may be used by the professional man to enlighten his client, as when the doctor explains an x-ray picture so that the uncertain patient will understand why he has to be put to the knife. Visual education is a fundamental way of learning, of acquiring information and understanding in practically any field.

Education Through the Camera's Eye

Visual documents, such as the photograph, have become an essential part of the process of learning. In schools, teachers have begun to realize that much of what we learn comes to us through our eyes and that effective teaching as well as learning can be obtained by making intelligent use of the camera. They have come to this realization partly because of the enormous development of photography as a means of communication. Words by themselves often create difficulties in learning and understanding. Too often people misuse words because they do not visualize what the words stand for. This is what the educational psychologist calls "verbalism," that is, the use of words without sufficient background or real understanding.

Teachers can now use photographs and other visual means so that the difficulties of verbalism can be avoided or overcome. They have access to all kinds of information that can be presented realistically in pictures, which they can use to provide concrete visual experiences. They can help make terms meaningful by supplying visual evidence that may serve to explain the terms and thus prevent misuse of words, faulty interpretation, or downright misinformation.

Photo-documents can be used not only to avoid the pitfalls of verbalism but they can also be used to dramatize learning, to create interest and hold attention. They can also be used effectively as time savers, enabling the

teacher to cover more ground in less time than could be done by words alone. For example, the concrete mass of Boulder Dam, its power station, its intake towers, its size, location and general layout can be described more quickly and efficiently in photographs than in words. Photographs are thus not merely aids to learning with words but they provide a technique of learning in themselves.

There are countless ways in which photo materials can be made useful in learning. All these ways will relate in some degree to the following three basic techniques:

1. START WITH THE PICTURE AND DEVELOP A STORY FROM IT. The method is to make an analysis and interpretation of the photo-document—whether print or slide—using details or the picture as a whole to bring out the story.

2. START WITH TEXT AND USE A PICTURE TO ILLUSTRATE IT. The method is to introduce photos at those points where they will pictorialize or illuminate the text to make the text clear and meaningful.

3. USE PICTURES AS INTEGRAL PART OF TEXT. In this technique both words and pictures are interwoven so that one cannot be successfully used without the other. For example, a lecture on Greek sculpture which would not include the showing of examples in support of the descriptions would be ineffective; on the other hand, a kaleidoscopic showing of slides on this subject without some accompanying explanation to point out details and general characteristics and to make summaries would likewise fail of its teaching purpose.

None of these techniques should be limited in any hard and fixed way. Their effective use will depend on the imagination and genius of the teacher, first in the selection and production of interesting and pertinent material, second in the organization and presentation of the material.

A Tool For Education

Any tool is fundamentally an extension of the human body, a mechanization of some organ of the body. A hammer, for example, is an extension of the arm and fist, made of harder and more resisting material but used in pounding or driving in the same way that the arm and fist would be used: the essential function is the same, the uses are increased and varied. In the same way the camera is a mechanization of the human eye, enabling us to cover more ground, ranging further in time or space than can the naked eye. It registers actions that will never be duplicated, fixes patterns that will never be repeated, captures sensations that will never occur again. With the microscope and the x-ray it can penetrate the inner activities and structure of materials; with the telescope and by aerial photography it can chart huge surfaces and vast regions; by telephoto and with the infra-red ray it can pierce distance and fog. Just as we must frankly welcome the typewriter as a tool in written communication so must we welcome the camera as a necessary means for visual communication.

THE CAMERA IN EDUCATION. The most important use of the camera is that made by students and teachers themselves. This is a matter not only of accumulating photographic materials, but also one of educational procedure. The experiences of a group of architectural students are illuminating. Their problem was to photograph the models they had made in the study of their buildings. (Photographs were needed for several purposes one of which was to show how the finished building would look on its actual site. This can be done by making a montage out of photographs of the site and the model: the result is to give a realistic view of the building in place, as it would look in actuality.) In photographing their models, the students were confronted with two main problems: the angle from which the building could best be seen, and the lighting that would best bring out the building forms. They had to consider whether the building would be seen from the usual view at street level, or whether an aerial view would show too much of the roof expanse or too little of the building itself. They had to decide whether to emphasize the mass of the building or its details. They had to think of the visual effect of the building materials, texture, light glare or reflection from glass and other polished surfaces. Out of all these problems they began to learn much about the building itself. They observed many things that they had overlooked in the design of the building and the making of the model. Out of their problem in photography they were learning about their architecture. One important factor was that by viewing the model at reduced scale on the ground glass of their camera they were improving themselves in an essential part of their training, the ability to visualize the design of a building at small scale. The camera was being used as a functional part of the process of architectural training.

The direct use of the camera thus provides training in observation and in recording work. It helps the intelligent use of photographic materials by investing them with personal interest and by helping create critical understanding and confident use of photo-documents. Finally it means an increasing accumulation of readily available documentary materials for study. This has been recognized in numerous schools and colleges who have set up official photographic service bureaus to supply class needs and to build up photographic libraries and files.

"WHAT KIND OF CAMERA SHALL I GET?" Perhaps the question that plagues an instructor most is which camera is best to use. There is no unqualified answer. The

principle of using the best tool for a particular purpose holds here; what may be best in one situation and for one purpose may not be best in another. Every possibility is needed for the most effective use of this tool in learning. V. P. Hollis, Manager of the Photographic Laboratory at the University of Minnesota, reports as follows:

"As the Photographic Laboratory is a service department serving the entire University, we require quite a variety of equipment and therefore do not feel the necessity of using one instrument for all purposes.

"In our department we make use of three Graflex cameras and one Speed Graphic camera. The Speed Graphic is used principally for synchronized flash shots and also for some athletic pictures, principally football and track events. The Graflex is a convenient all-around camera for outdoor photography. We use it considerably for news shots, animal photography, and small groups. We also use the Graflex to a limited extent for portraiture. Personally, I like and use the Graflex a great deal for pictorial photography."

As a general guide then, the values of the Graphic camera in education may come in the documentation of details, making careful studies of textural qualities of materials and forms, and preserving maximum tonal gradations in the large size of views, permitting in many cases a greater command of area and definition of detail. Also in the greater depth of field that may come with smaller lens openings useful in copying or other realistic recording of particular advantage to educational purposes where detail must be mercilessly exposed and meticulously recorded.

Still another value may come in the use of the Graphic camera as an aid to learning and training in observation. One teacher of photography even advocates the use of the copy camera to begin training so that the student can plan and study a picture carefully, its lighting arrangements, its composition, its coverage, and its documentation of detail. From this angle, the ground glass for viewing the image is of special value for profitable preparatory study of the shot to be taken. The picture can be organized for its special purpose to present in the most effective way what the picture has to say.

Photo-Documents

Photo-documentation has been at hand in the newspaper and the magazine as well as in the textbook and its use has been greatly accelerated by the advent of the pictorial magazine. In addition there has been a growing accumulation of photographic materials in the commercial agencies, and in collections and portfolios especially prepared for classwork.

In addition to the newspaper and magazine, schools have turned to advertising agencies, travel offices, gov-

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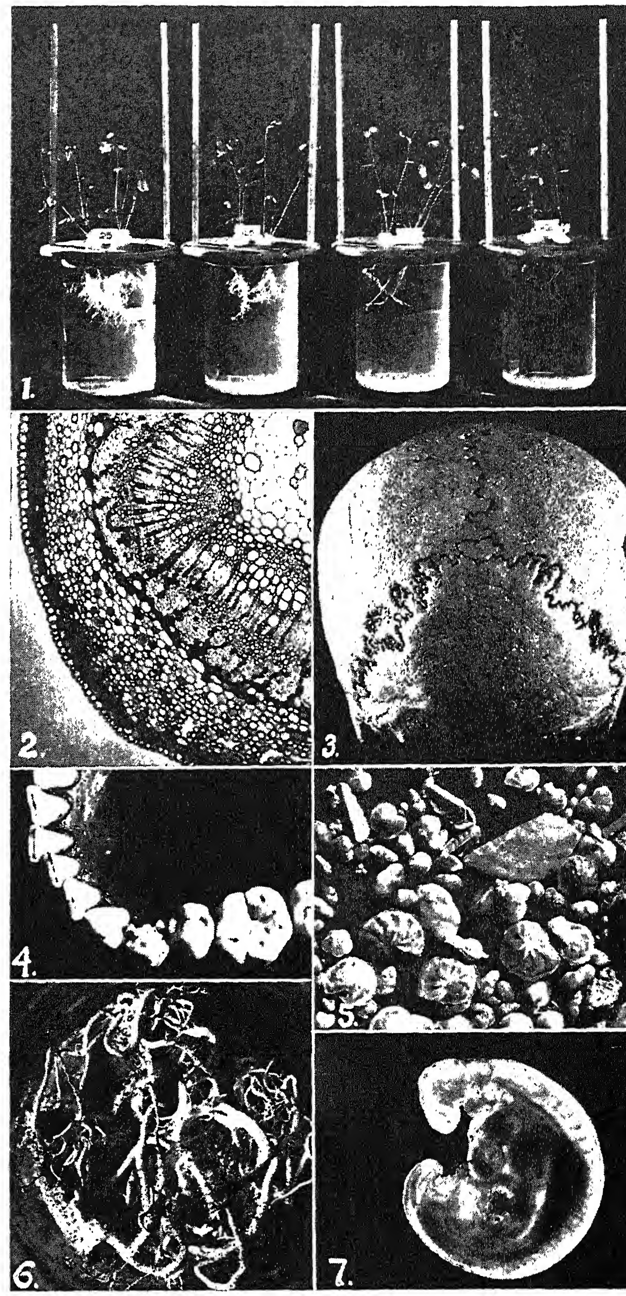
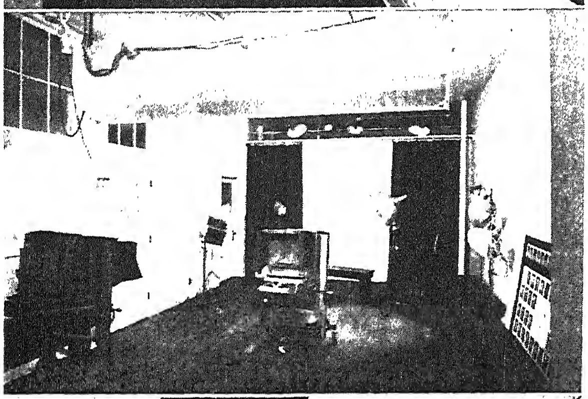
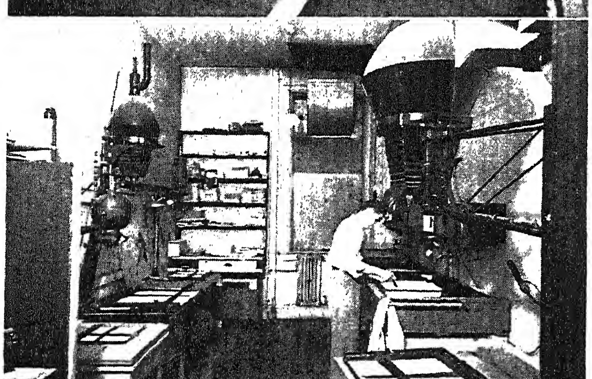


Photographic examples from the University of Minnesota Photographic Laboratory.
1. The study of plant growths.
2. Photomicrograph of plant tissue.
3. Human skull for close study.
4. Dentistry requires closeup pictures.
5. Microscopic shells are photographed.
6. Mushroom spores require careful photography to bring out fine details.
7. Even the embryo of a sheep is photographed for visual study.





8. General office at the University of Minnesota Photographic Laboratory.
9. The main studio.
10. Lantern slide room.
11. The special enlarging room in the photographic laboratory at the University of Minnesota.

THE PHOTOGRAPHIC

BY V. P. HOLLIS, *Manager*

The Photographic Laboratory at the University of Minnesota is a Service Enterprise, offering a complete photographic service to all departments, staff members, and students. This department is maintained through the sale of its services to other departments and individuals, plus a small subsidy to cover part of the overhead expense. The present regular staff consists of nine full-time workers plus some part-time student help.

The studio, work-rooms, offices, and darkrooms occupy approximately 3500 square feet. Separate rooms are provided for developing negatives, contact printing, enlarging, lantern slide making, and a separate loading room attached to the photomicrograph room. These rooms are lighted according to their individual requirements, and are all provided with light trap entrances so that they can be entered at any time while work is in progress.

Our photographic work covers a wide variety of subjects, including:

Illustrations for publication.

Kodalith negatives for offset printing.

Photographs of all kinds of specimens,—animal, insect, plants, fruits, grains, vegetables, dairy products, prepared foods, textiles, and clothing.

Athletic pictures, including individuals, groups, and action shots.

News photographs.

Architectural subjects, both interior and exterior.

Student activities in classrooms and laboratories.

Experimental apparatus.

Progress records of experiments, frequently extending over a period of several months.

Copying charts, graphs, maps, and photographs.

Exhibits in the University Gallery.

Publicity shots for the University Theater and records of stage sets.

Record photographs of experimental apparatus in Engineering, Hydraulics, Mines, and Agriculture.

Field plots and animals.

4-H Club Demonstrations and exhibits at the State Fair and Livestock Shows.

X-ray.

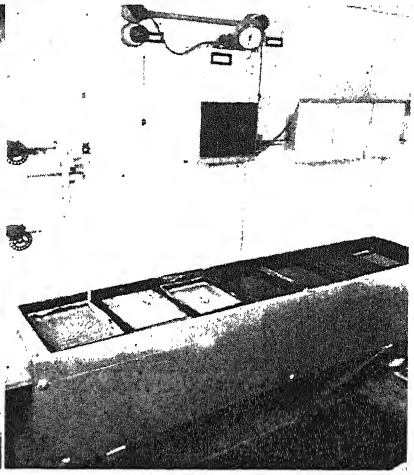
Photomicrography.

Lantern Slides in black and white and in color.

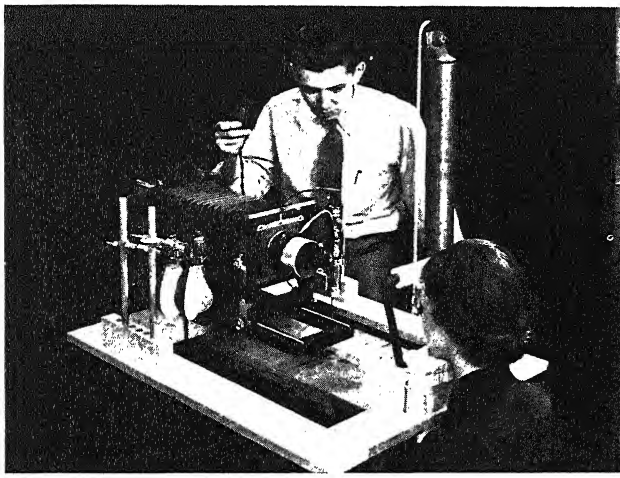
There is an art department devoted principally to the designing and making of bulletin covers, posters, and charts. We also do photographic finishing, including developing, printing, enlarging, and mounting for departments and individuals. *(end)*

LABORATORY AT THE UNIVERSITY OF MINNESOTA

12. **OVERHEAD CAMERA** used for special copy work at the University of Minnesota Laboratory.



13. **DEVELOPING TANKS** in the main negative processing room.



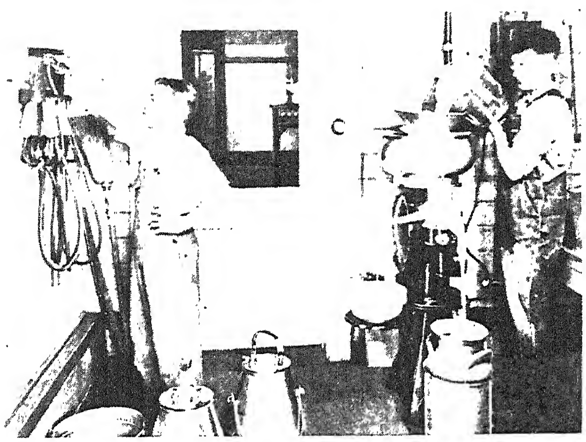
15. **EYE PHOTOGRAPHY.** A special synchroflash setup is used for photographing eyes. Note synchronizer and flashbulb.

16. **CONTACT PRINTING ROOM** where there is ample room for carrying out all of the printing work required at the University of Minnesota Laboratory.

(continued from page 111)

ernment bureaus, and similar sources. One curriculum group is making educational history in sponsoring the publication of BUILDING AMERICA, a series of visual texts devoted to the photographic presentation of contemporary American problems. Book publishers have likewise turned to visual texts, mostly for children's books, although there is no reason why they cannot supply similar texts for adult levels.

ONE OF THE CHIEF PROBLEMS COMES WITH FINDING THE RIGHT PHOTOGRAPH. This applies not only to school work but to any kind of documentation where there is a basic educational problem of supplying information or putting over an idea. The time is not far off when the publisher will assign photographers to illustrate a text much as they assign the artist for graphic work, or as newspapers and magazines assign reporters and cameramen to cover a story. At the present time, photo-illustrations for a book are gathered as best they may from commercial agencies, travel bureaus and similar sources. What is needed is a carefully planned attack in charge of a photographer who will be able to supply all necessary illustrations from his own and others efforts. New lines of work are opening up to the photographer in this direction: in spite of the tremendous



17. The intent of this picture was to illustrate a cream separator. The print is very weak with no detail and gradation of tones. Note how the large central portion of the composition divides the picture so that interest in the machine and in what the people are doing at the machines is destroyed. The view through the door in the center only distracts. The main point of the picture is lost because of the division of interest created by the photographer giving almost equal attention to all the objects in the room. The lighting is so distributed that the eye has no help in finding the main object. This illustrates how a picture that does not "teach" well also fails as good photography.

amount of photographic production that has taken place, there is still a major task to be done in supplying photo-documents. The important point is that such work must be keyed to the particular needs of education rather than force the use of secondary material to do the job.

In the school itself much of this work is being carried on by students, teachers, photographic bureaus and laboratories. Some city systems and colleges have set up photo organizations to produce the materials needed for instruction. The growth of this activity demonstrates its importance and has already created jobs and opportunities for the photographic worker in and out of schools over the country. Camera clubs and photo bugs have advanced beyond the status of the amateur and the dilettante. They have progressed beyond the state of doing the work only for the fun of the thing: they are becoming a functional part of the school program in contributing material for classwork, in preparing photo-documents as part of reports and studies, and in photographing the world about them.

WHAT MAKES A PHOTO-DOCUMENT? It is the documentary nature of the photograph that has special value in learning and teaching, and it is that kind of photograph that is essentially documentary that has the greatest contribution to make. Two factors come into consideration. *First is the intention of the photographer.* The same subject can be treated differently for commercial, pictorial, or educational purposes. While this does not mean that the documentary photograph should not be esthetically satisfying and while it does not rule out the news photograph or the pictorial photograph, it does suggest that the photograph of only transient interest or one that is merely a "pretty picture" is not the most effective type for educational use. *Second is the problem of interpretation.* Pictures are not necessarily instructional in themselves. Often they are not really studied, often significant features are not seen. Details which suggest relationships may be overlooked and the relationships themselves thereby ignored.

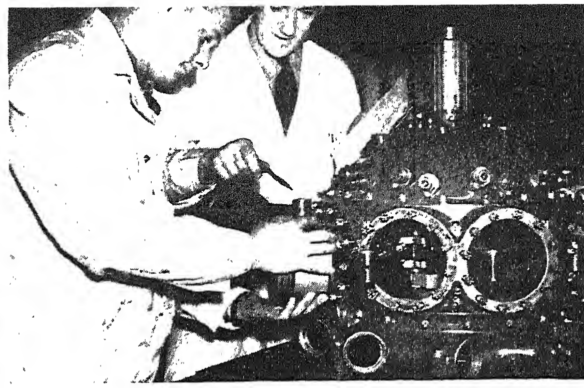
Educational photographs should be social, historical, and technical documents. They must bring to view the minute and the vast, bring to light and sight the easily overlooked detail or the detail difficult to get at. They must be essentially realistic. They must contain both in subject detail and in photographic treatment, the possibilities of discerning relationships. By careful choice of angle of view and by imaginative use of lighting, the documentary photograph should express its information directly; it should economize attention. It should permit prolonged study without loss of interest. *That kind of camera documentation is needed which shows a significant subject in revealing detail with clear exposition of textural, formal, and tonal values: it should show the relation of the subject material to human beings and to human use; it should arrest action in such a way that the suspended event can be studied and learned effectively.*

IN THE CLASSROOM. Our interest in the instructional use of the Speed Graphic and Graflex cameras can be centered on the large size print and on the standard size lantern slide. The print is primarily an aid to individual study, the picture being close at hand and more or less directly combined with other materials of the lesson as is the case in book illustration. The slide is, when projected on the screen, a problem of group use. Each photograph, print or slide, is essentially an arrested action, one paragraph or chapter of a whole story. Its effective use therefore depends on how well each scene is fitted to the scenario. Each picture therefore must meet two requirements: the qualities of its content, and its qualities in relation to a series of pictures.

It would take a volume of considerable length to go into all aspects of making and using photographic materials in education. The particular aspects concerning the use of the Speed Graphic camera are implicit in the nature of this tool: its size, its power for detail of texture and values, its possibilities for control in operation, production and result *all directed toward the special educational needs of documentary photographs.* There are three major aspects that might be considered here:

(continued on page 116)

18. About two years of regular study are required before a student can pass a government test for piloting a scheduled passenger plane such as the one above. Then he begins training in air lines' schools. American Airlines Photo.



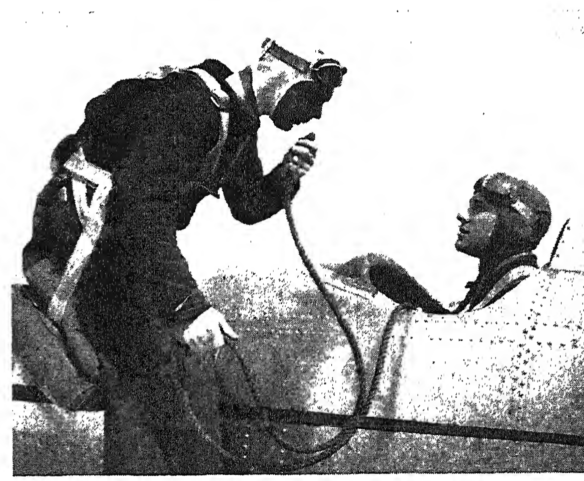
20. Under the guidance of his instructor the student begins work. He should know how to keep his engine in good condition and how to repair the engine when an emergency arises.

THE MAKING OF A PILOT

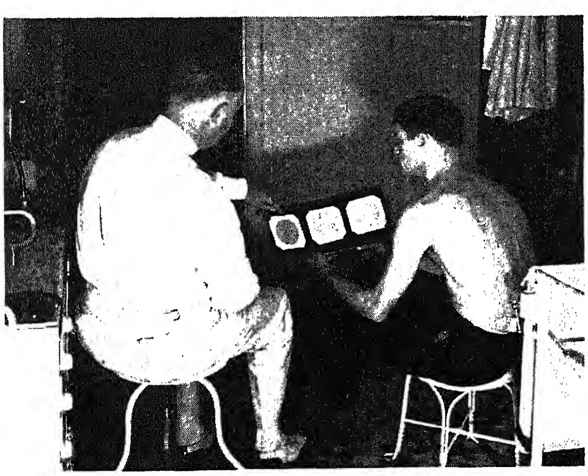
as presented in Volume IV, No. 1 of

BUILDING AMERICA . . . A PHOTOGRAPHIC MAGAZINE OF MODERN PROBLEMS

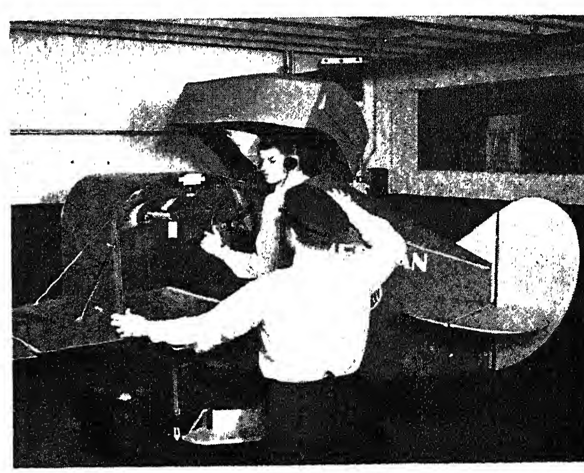
One of the most significant publications in the field of Visual Education is the magazine "Building America" which comes out each month during the school year. Each issue emphasizes a special subject such as aviation, transportation, advertising, men and machines, conservation, safety, and many others. The pictures on this page are only a few selected from the Aviation number. All photographs are fully captioned with an accompanying descriptive story. This material is used very effectively for educational purposes. The editorial offices of "Building America" are located at 425 West 123rd Street, New York City. The magazine is issued by the Society of Curriculum Study and distributed by E. M. Hale & Company, Milwaukee, Wis.



21. Giving instruction through a speaking tube as student and instructor prepare to take off in a plane with the student at the controls. Both men have parachutes strapped to them. Photo from Ryan School of Aeronautics.



19. Among the many eye tests by the airline doctor is this one made for color vision. Good color vision prevents mistakes in recognizing signals on the ground and on other flying planes.



22. A "trainer" for instrument flight. The hood comes down, the sides go up, the student is in darkness. But the instructor knows how he is handling his plane on this stormy night — indoors. American Airlines Photo.

(continued from page 114)

A. Using the picture. Photographs serve three main functions: they objectify, enrich, and dramatize. The following points may guide the functional use of pictures:

a. Often one picture will serve as illustration for more than one field. (This indicates an advantage in school production of photographs where the negative may be on hand for several classes.) Pictures can help visualize:

1. *Place*, showing location, environment, surroundings. This is the field of the geographer.
2. *People and their activities*, dress, habits, and how they live and what they do. This is the field of the sociologist and economist.
3. *Events*, showing incidents and happenings, giving evidence of time and changes. Details of styles, happenings, etc., can be interpreted, documents can be copied. This is the field of the historian.
4. *Things*, showing the nature and use of objects, tools, machines, materials, etc. This is the field of the scientist and technician.

b. HOW TO USE PICTURES. Three basic principles can be followed:

1. *Contrast*, showing differences in materials and forms, in sizes, in elements of time. For example, photographs of hand weaving of Indian rugs can be contrasted with those showing modern machine manufacture of large broadloom carpeting.
2. *Comparison*, showing different angles of the same subject emphasizing differences in time and position in space. A tree may be shown as it appears in different seasons, it may be described pictorially by showing it in its characteristic habitat, then by a closeup of its bark, then by a view of its cross section.
3. *Continuity*, showing progressive stages of development or operations so that a process or any of its steps can be properly understood. An isolated shot of one step in automobile manufacture may not be enough to provide a clear understanding of the assembly line.

c. INTERPRETATION OF PICTURES. In using pictures, seeing should be developed into observation: that is, analyzing and interpreting what the eye takes in:

1. *How to look at pictures.* Analyze the subject and what the subject is doing. Study the composition to see what is dominant and subordinate. Pick out the significant details, those which contribute to the main idea of the picture. See which parts of the picture add to the effectiveness of the whole and which detract. *Consider the intention of the photographer and how he has carried it out. Make an analysis of how the picture was taken, the position of the camera, the view taken, and the lighting chosen.* Such an analysis can lead to important deductions and can disclose ideas which would

(continued on page 118)

PHOTOGRAPHS TO AID LEARNING

BY W. M. GREGORY, *Director*

The function of the camera in learning is to produce an illustration that is "almost real" in pictorial form that is convenient to use with small or large groups. The accurate use of the camera to obtain working material is not realized nor utilized by instructors. Haphazard pictures are too often poor makeshifts whereas accurate pictures fitting the units of instruction can be produced by the camera in the hands of the teacher who knows pictorial value.

The camera can create for any school definite unit sets of photographs of the community's social agencies at work such as the fire and police departments, the council, the water supply, the disposal of waste, the markets, the streets, the parks, the people at work, safety, local industry, means of transportation, the problems of taxation, the methods of voting, etc. It is possible to use local pictures to implement so well the community problems that pupils become really sensitized to the importance of their immediate social activities.

Field studies of the above activities are rather arduous and even dangerous for large groups of pupils unless given much well-planned supervision. Sending pupils in small groups without teachers to visit industries, docks, and other observation trips is not satisfactory.

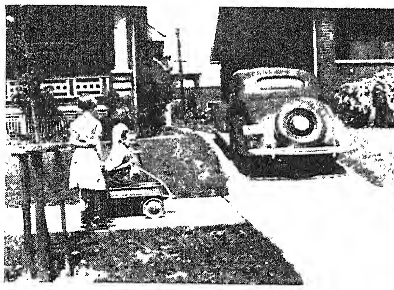
The camera can aid in some of the difficulties of the field studies. First, in all field trips, the pupils will benefit if they can study good pictures of the places they will visit and on the return such pictures are valuable for checking, reviews, and future observations. In the second situation are many pupils not able to do field studies and hence the pictures bring them experiences that are second to the actual first-hand observations.

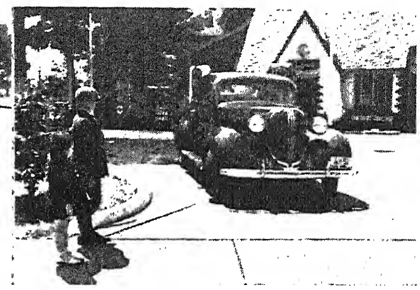
It is important to observe that such pictures are more than the casual holiday snapshot. The pictures are deliberately made to have a continuity, to reveal facts, to make records, and to show present conditions. Again it is important that such pictures should be carefully documented as to 1) date and time of year, 2) place, 3) identification of all buildings, streets, structures, etc., 4) names of all physical features such as rivers, mountains, hills, etc., 5) items of flora and fauna, 6) size and distances, 7) weather conditions, floods, snows, etc., 8) names of all people, 9) the work, processes or results of labor, 10) social impressions suggested by conditions pictured.

It is very necessary that each picture be fully documented by material that is *closely relevant* to the pictorial subject. The picture alone has value but the above ideas applied to each subject give additional service.

Before pictures are made there should be considerable planning. The learning units to be pictured should be selected and studied as to their need of pictorial material. Pictures supply certain essential ideas about which definite lessons are centered. The pictorial needs

AT THE EDUCATIONAL MUSEUM . . . CLEVELAND PUBLIC SCHOOLS





24. Safety photograph to illustrate how children must wait for a car to back out of a driveway.

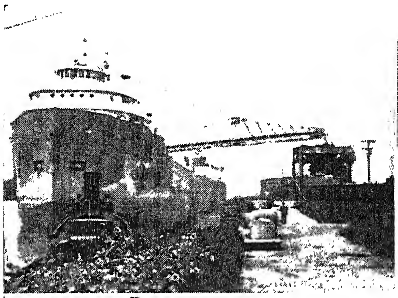
25. Before crossing a street look to the right and left as a safety precaution.

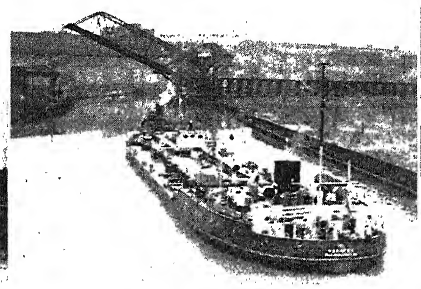
26. Children are taught to stand by as a car drives out of a filling station.

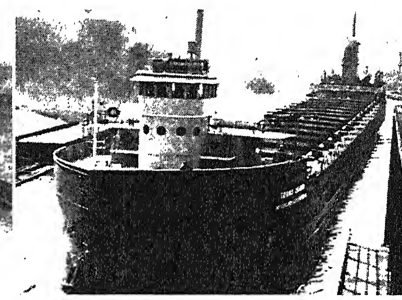
27. "S. S. CARL BRADLEY" unloading calcite and crushed limestone. Longest boat (615 feet) on the Great Lakes. The unloader with a 110-foot arm is in operation.

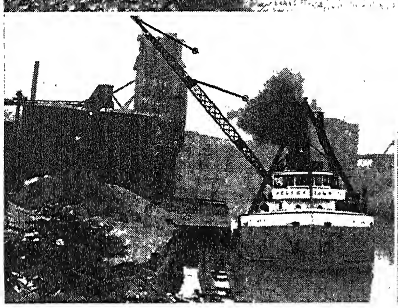
28. THE "PARATEX," oil tanker, is loaded with 84,000 barrels of gasoline. A modern lake tanker type for transporting great quantities of oil between lake ports.

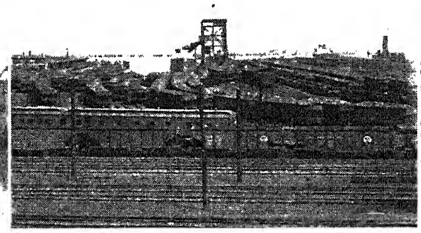
29. THE "GRAND ISLAND" (480 feet long) loaded with iron ore moves slowly up Cuyahoga River. Its 14 hatches are opened and it is ready to be unloaded.











30. THE "KELLY ISLAND" (200 feet long), a sand sucker, unloading its cargo. Sand is sucked from the bottom of Lake Erie and it is unloaded from the grab bucket.

31. LAKE FRONT at Cleveland. Coal loading machine at work. Trains of coal waiting to be dumped into boats.

32. COKE PLANT produces coke from coal for steel mills. Ovens and quencher in foreground and tanks for tar, gas, and coal crusher in background.

should be drawn up in a detailed prescription as a guide for the cameraman. The preliminary organization and a careful survey of the pictorial requirements of each unit are the key to obtaining worthwhile visual aids. No pictorial material should be made or purchased until the same has been adjusted to use in some instruction unit. School executives are finding teachers quite anxious to work with materials that are adjusted to their class work. An example is illustrated on this page in a unit on the transportation of heavy raw materials by water into the city of Cleveland.

These few pictures are samples selected to show continuity and modern conditions in the problem of transportation of heavy raw materials. They are used widely in the Cleveland Public Schools in the regular seventh grade course of study of the industries of Cleveland.

In organizing material for safety teaching, the camera in the hands of the safety director of the police force, assisted by one of the school principals, gathered photographic material for school use in the field. The three pictures at the top of this page were taken to illustrate how important safety ideas may be presented in a positive manner so that children know what to do as emergencies arise. *(end)*

(continued from first column, page 116)
otherwise be missed. After the first impression, take a second and third look to see what details and ideas were missed at first. Describe or discuss your analysis of the picture.

2. *Making the photograph meaningful.* Full interpretation of a picture includes bringing the facts of the picture within the range of familiar experience. A photograph is a two-dimensional abstraction of reality and it may be necessary to bring out associations of the subject and its details in order to give the picture its fullest meaning. *Motion* of inherently dynamic things such as people and animals may be felt in the pose of the subject, and its method of movement. *Size* can be identified in the relation of the object to the human body or some familiar object like a chair or pencil. *Weight* can be interpreted in the nature of materials. *Color* can be identified in associations such as the time of day, and the color of everyday objects. *Distance and depth* can be identified by lines of perspective, by the aerial perspective of light gradations and diffusion, and by the diminution of size in perspective. *Temperature* can be interpreted by the state of vegetation, or by the type and amount of clothing. *Sound, odor, taste and tactility* can likewise be made real by calling upon some corresponding sensory experience to comprehend the full content of the picture.

B. Showing the Picture. The effectiveness of visual education depends in great measure on the way visual materials are presented. The showing of pictures can be made intensely interesting by knowing how to catch and hold the attention of the audience. Two factors are important. First, a sense of the dramatic possibilities of the presentation so that there will be a more sensitized reception; second, elimination of distractions and interferences that tend to shift or dissipate attention and interest. The following should be considered.

a. SIZE AND FINISH. The minimum effective size for individual prints is 8 x 10 inches, although a negative should not be forced in enlargement if it means great loss in sharp definition of detail or in brilliancy of tonal gradation. Pictures grouped in a single spread or used in conjunction with an appreciable amount of text can be smaller but not beyond the limit of losing significant details. Glossy prints are generally best since rough papers may obscure details or reduce the range of tone gradation depending upon the subject and size; prints which are handled can be turned to the best light so that any undesirable glare that might come from a glossy surface can be avoided; large sized prints put up on the wall usually have a matte finish eliminating any glare.

b. MOUNTING AND PRESERVING. Mounting will depend on the subject, the use, the lesson, and the print itself. Prints can be posted on bulletin boards or placed on walls as photo-murals. They can be mounted on cardboard or on composition panels which can be folded and hinged. This can be done for both single prints and group layouts. Simple, appropriate lettering should be used for titles and captions and color can be introduced to set off a photograph as background or frame. Preserving the picture usually requires planned systems of storage and filing. Surfaces should be protected from the ravages of dirt, hands, and carelessness; at the same time, pictures should be accessible for constant use and as a matter of simple efficiency should be identified and titled so that they can be readily reached in file or storage.

c. COLLECTIONS. While the individual print is a common visual aid, photo-documents will naturally fall into subject groups. Prints can be brought together in portfolios, file collections, or bound visual-texts. Negatives should be filed separately so that duplicate prints can be made to build subject groupings. Permanent file prints of each negative should be made for reference. Loose-leaf bindings may be of definite advantage: the principle of flexibility should be honored as much as possible.

d. LAYOUT. In the grouping of pictures, the problem of layout becomes of prime importance. The function of a layout is to create unity through coordination and integration. Excellent models of layouts can be found in contemporary advertising, the pictorial magazines, and modern typographical design. Each layout will depend on the subject and the available material but the following principles may be observed.

1. *Planning.* The layout should be the result of careful planning and organization. The final size of the layout should be determined. With the pictures to be used at hand it is wise to make a sketch of the scheme or schemes of possible arrangements. Before the actual mounting is done, temporary mounting may allow adjustments in design.

33. This youngster learns about mud and silt as it dries out and forms this pattern of open cracks. $3\frac{1}{4} \times 4\frac{1}{4}$ Series B Graflex. Photo by C. A. Maginn.

2. *Design.* The best layout is the simplest one that explains one major idea as orderly as possible. Photographs of varying size can be used but each one should be subordinated to the group as a whole. It is often an advantage to have one large picture to provide a dominant element in order to catch and hold attention. Do not use more pictures than are necessary to put over the idea and make sure that each contributes effectively to the story.

3. *Eye Control.* The pictures should be laid out so that the pattern of blacks and whites aids the eye in moving from the beginning to the end of the story. Large white voids or heavy black masses can block eye movement. This may be desirable in some cases for emphasis and dramatic effect.

4. *Drama.* While bizarre effects should be avoided, a dynamic arrangement has more attention value than a static or commonplace arrangement. Pictures can be cut into various shapes and fitted together to create a unified layout; on the other hand, if they happen to be of the same size and importance a simple row and block arrangement may give the best result: the drama need not be turned into a circus.

5. *Accessory material.* Titles, captions and explanatory text should not intrude on the pictures. The layout should be strong enough to tell its story visually. Lettering, directional lines, arrows, and color can be effectively used to strengthen the arrangement. Any device is legitimate as long as it does not interrupt the story or interfere with the meaning.

C. **Getting the picture.** In spite of the popularization of the camera and the flood of photographs produced and reproduced, far too many teachers feel at a loss when they face the need of getting pictures for their work. One of the chief difficulties is that they rarely can find just the right photograph for their purpose. But here is a challenge to their resourcefulness: One avenue is wide open—*production in school.*

a. *Sources.* Photo material can be obtained from the following sources:

1. Magazines, postcards, newspapers, books, advertisements, catalogs, travel literature, government reports. A good deal of this material can be saved as clippings; other documents can be made by photographic copies of posters, illustrations and similar graphic work.
2. Photographic services and agencies, local photographers, governmental agencies, industries, newspaper files.
3. School, city, and state departments of visual education, museums, libraries.
4. Original camera work in the school.

b. *Guides for getting photographs.* These are a few suggestions for getting at the sources:

1. Have students canvass the community, especially their own homes, for discarded magazines, books, and pictures.
2. Survey the local community or the region for those firms, industries or agencies which are willing to make photographs available.
3. List national agencies, government bureaus, and associations which distribute visual material.
4. Canvass the local photographers.
5. Organize class or school camera clubs or establish a photographic service in the school.

34. GROWTH OF CORN EAR. Scale photo showing 2½-inch ear of corn at two weeks; then at four weeks; and the almost mature ear at top. Purpose was to show how each kernel has its own tassel of silk through which it receives nourishment. 4 x 5 Speed Graphic. Photo by E. K. Langevin.

6. List publishers of photographic materials and their publications to help build a photographic library and morgue.
7. Use a camera.

c. *School production.* This method of getting pictures may prove to be best. Original work can be done in the field and copies can be made of those subjects that cannot be reached directly. It should be remembered that the most effective learning from pictures may come in making them.

ORIGINAL CAMERA WORK IN THE SCHOOL. Direct personal experience greatly improves the chances of meaningful learning. Camera work by student and teacher should be based on a carefully planned procedure where both are willing to learn in the actual process of taking and making the picture, considering the purpose, the relation of each shot to the subject, the selection of significant detail and angle of view, the control of lighting for accurate and revealing tonal values. The procedure should be that of good educational practice:

A. RESEARCH. The need for careful preliminary research cannot be over-stressed since this is a fundamental part of learning to think and the first stage of any planned work.

a. Determine what the purpose of the work is and what materials will be needed to carry out the purpose.

b. Analyze the problem from as many points of view as possible to determine which is most pertinent.

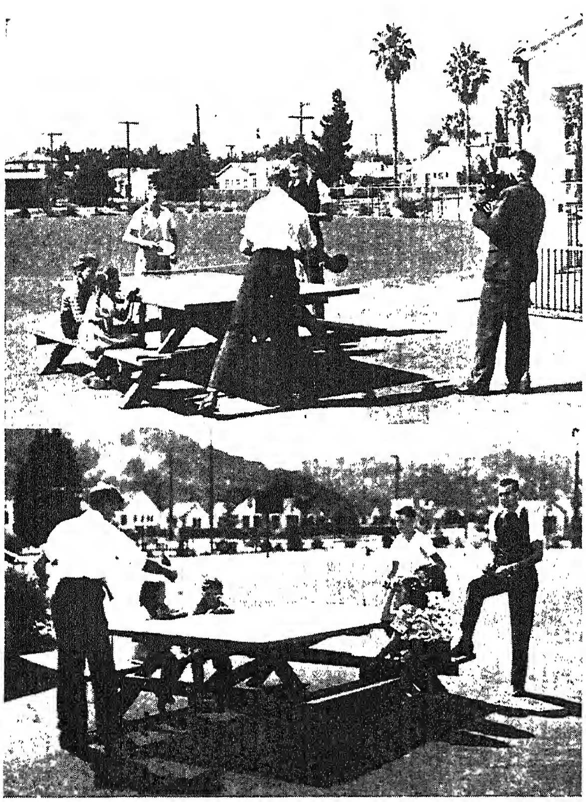
c. Consider all aspects, historical and technical; consider how the subject should be related to its environment and to human beings so that the factors of geographical background and human interest will not be overlooked.

d. Canvass all sources for the materials needed, and collect all the necessary facts in some orderly arrangement.

e. Keep a record of all research work.

B. PREPARATION OF A SHOOTING SCRIPT. This too is not only a question of getting better photographic results, saving time and materials, but it is also part of the technique of learning by doing. It provides a blueprint for the job, a detailed outline of what is to be shown, and how. The shooting script is a master plan based on the research which can and will be modified as the work progresses, since ideas will develop in the actual shooting. The script should contain three elements: 1) Titles and outline of what is to be shown. 2) List and description of the photographs to be taken. 3) Directions and notations of views to be taken, angles, lighting, backgrounds, colors, accessories and other technical points.

C. PREPARATION OF EQUIPMENT AND SUBJECT. a) Before shooting, all equipment, camera, film, plates, lighting equipment, and darkroom should be prepared to eliminate loss of time and waste of movement. Lack of a filter can spoil an afternoon. b) Certain subjects such as those out of doors may need special planning for light conditions; a visit to a plant or hospital may require making of appointments and preliminary work in studying the setting before equipment is set up and shooting takes place.



35. (*top*) Using the Speed Graphic for sport picture closeups among the younger students in the Santa Barbara schools. Speed flash is used to obtain better modeling in daylight. (*bottom*) The actual photograph made from the picture setup shown. Photograph from Francis W. Noel. Top photo by Dixon L. MacQuiddy.

D. SHOOTING. To experiment is to follow modern educational practice. Do not hesitate to use film in taking shots from several angles and with different exposures. Much "extra" material will be valuable; besides, unless you can develop the pictures on the spot, there are several risks in relying on only one or two shots. In shooting, number and keep a record of each exposure, the subject, the timing, and other notations of both camera work and the subject.

E. TECHNICAL PROBLEMS. Technical questions of the mechanics of taking and making the picture with the Graflex and Speed Graphic cameras are answered throughout this book. Careful study of the chapters on copying, newswork and the rest will indicate the practices and procedures to be followed.

The Visual Education Department in the Santa Barbara school system in California has worked out the use of photography very successfully. Francis W. Noel, Visual Education Director, has prepared the following description about the active visual work he is doing. This is a practical application which will emphasize the previous information given in this chapter:

The Camera In School Work

Versatility, flexibility, and adaptability are three characteristics that make the Graphic camera, with its various attachments, the most desirable camera made for school uses. The Santa Barbara City Schools use two of these cameras. Both are completely equipped with Kalart range-finders and Kalart Speed Flash synchronizers. One, a 4 x 5 Speed Graphic, is used for taking large groups, and for action sport pictures, as well as news reporting of school activities. A second, 2¼ x 3¼ revolving-back Graphic camera, is used in a wide range of work especially connected with the Visual Education Department. This work includes:

PHOTOGRAPHS OF CLASSROOM ACTIVITIES. In photographing classroom activities in the schools we find that the shorter focal length lens of the Graphic camera gives a greater depth of field. During the past two years we have taken approximately 1000 pictures of classroom scenes and other activities in the Santa Barbara City Schools. These pictures have found their way into many educational publications, including the *N. E. A. Journal*, which in 1938-1939 printed eight series under the title, PEDAGOGY THROUGH PICTURES. (See Figure 39.)

These pictures are also used in many ways within the school system, including the following:

a. As a record of classroom activities. Santa Barbara City Schools for the past several years have undertaken an extensive curriculum revision program, with a view of placing in operation classroom procedures based upon modern concepts of education. The camera has been found a valuable tool to record classroom activities in line with this philosophy.

Where teachers are doing outstanding work in accord with the revised program, pictorial records are made of their activities and procedures. These pictures are then used by the curriculum director and heads of the other departments in teacher meetings and in individual conferences. Experience has taught us that the "spotlighting" of exceptional work in this manner is an important technique in aiding the revision program. Teachers feel complimented at the emphasis placed on their work in this manner.
b. Photographs are also used in the superintendent's permanent record of the curriculum revision program.
c. Photographs are used to interpret the curriculum revision program to the public in the form of individual pictures of various activities, pamphlets, and reports.

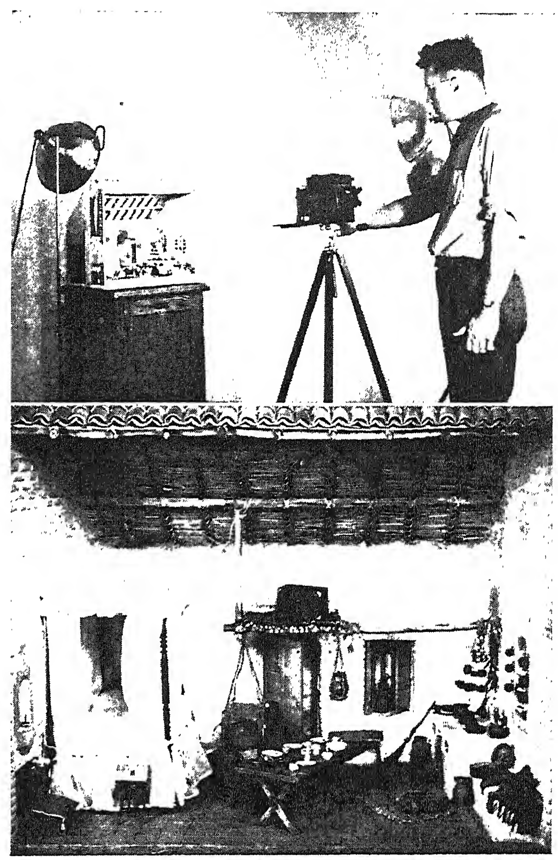
GROUP PICTURES. The school annual is universally accepted as a means of recording for students of the various phases of student activities. The Speed Graphic camera is peculiarly suitable for producing pictures for annuals, the Focal Plane Shutter making possible the "catching" of numerous action shots through the year. The ground glass focusing makes possible accurate composing of numerous group pictures so necessary for the successful book. The Speed Flash synchronizer opens up the entire inside life of the school which a few years ago was a "closed book" as far as good illustrations were concerned.

SPORT PICTURES. Action sport pictures represent an important field for serious photography. Aside from the personal desire of participants and their friends to have pictures of sport events, photographs of the players in action are also an important tool in illustrating good form and techniques in the field of sports. Photographs give ample opportunity for leisure study on the part of the student and coach for improvement of performance.

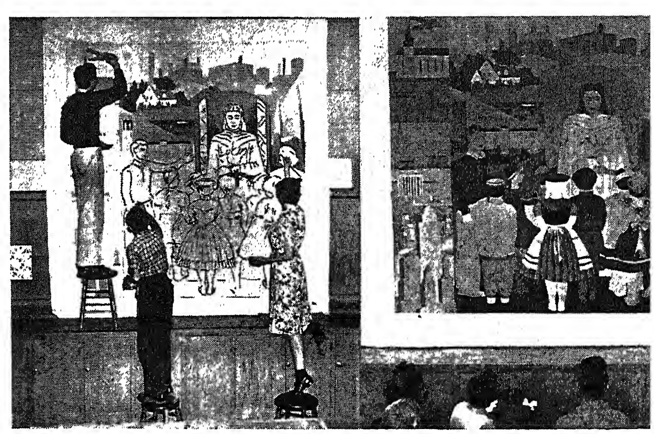
COPYING. With the modern trend toward profuse illustrations in reports, pamphlets, and books, it is increasingly important for school systems to have at their disposal efficient photographic copying equipment. Here again the Graphic camera, with its many auxiliary attachments, is an efficient and accurate device for doing this type of work. In the Santa Barbara City Schools the small Graphic is used extensively for this work.

PHOTOMICROGRAPHY WORK. Schools have been comparatively slow in developing materials for this type. In a modern curriculum program such material is greatly needed throughout the entire school system. Where formerly such materials were used almost exclusively in the upper grades of the secondary schools, need now arises for it in the lower grades. Again the camera proves its versatility in this work, with its easy adaptability, with a microscope, to produce photomicrography pictures. (See Chapter on Photomicrography.)

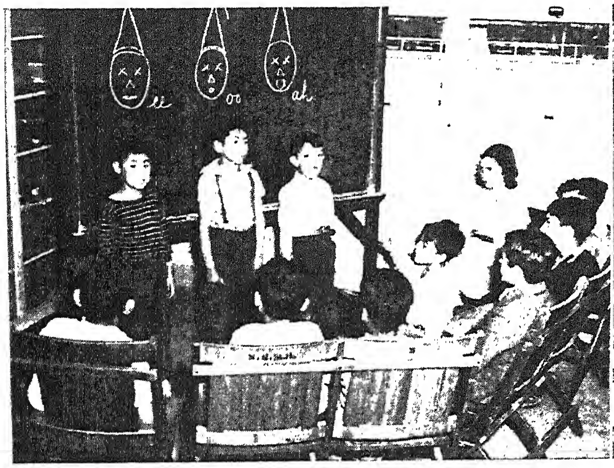
SPECIMEN PICTURES. It is often difficult or impossible to make available specimens of plants, seaweeds, shells, rock formations, minerals, and other materials in the classroom because of perishability, size, or some other limiting factor. In such cases, pictorial records of these materials can be developed with the camera. The Graphic, with its long bellows extension, ground glass, and other features, is admirably adaptable for this type of work.

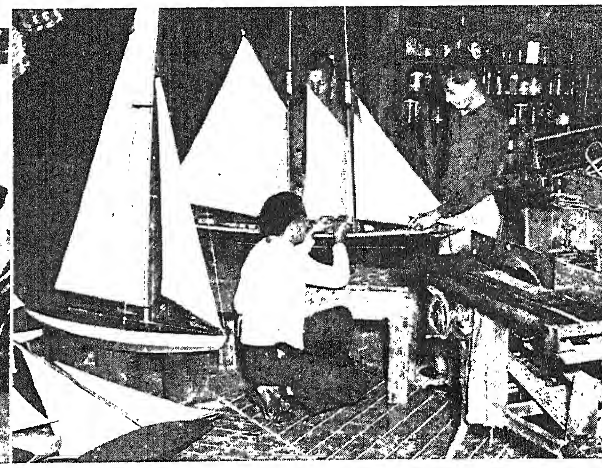


36. The Speed Graphic camera is used in many different ways. Here we see a setup for the photographing of a small diorama. Bottom picture shows the resulting exposure. Photographs from Dixon L. MacQuiddy, assistant photographer, Visual Education Department, and Francis W. Noel, Visual Education Department, Santa Barbara City Schools.



37. The complete stages during the making of a mural photographed for later study. Photo from Francis W. Noel, Santa Barbara City Schools.





38. Synchroflash photography forms a very important part of the photographic work in the Visual Education Department of the Santa Barbara City Schools. Here we see a speech correction class at the left, and a boat building class at the right. Photographed by Dixon L. MacQuiddy. Two speed flash photographs.

SEQUENCE SERIES OF PROCESSES. In order to understand technical processes, it is often necessary to have pictures taken in sequence of the operations involved. These pictures usually require close-ups, and often must be taken under difficult photographic conditions, necessitating quick accurate focusing and the use of flash illumination. The Graphic equipment, including the Kalart Lens-Coupled Range Finder and Speed Flash, makes possible the accurate recording of pictures of this type.

LANTERN SLIDES. School systems in particular need lantern slides of pictures suggested in the foregoing paragraphs. The rendering of pictorial material in this media is especially desirable with the large number of standard lantern slide machines and equipment owned by school systems. The Speed Graphic and also the Graflex cameras make negatives with inherent qualities necessary for good lantern slide pictures.

CAMERA CLUBS. Where schools maintain camera clubs and photographic classes, photographic equipment is essential to give a basic understanding in photography. Having a camera which is universally used by professional photographers the world over is of first importance in giving students first-hand experience in picture taking. A camera club or photography class with this modern equipment has at hand the basic tool needed for professional photography.

In the Santa Barbara City Schools negatives made from the Graphic camera are processed in a laboratory in the Visual Education Department, equipped with a Drum Washer and Eastman 5 x 7 Auto-Focus enlarger.

This concludes an actual application of visual work as given by Francis W. Noel.

"Next Slide, Please!"

From the early days of the magic lantern, people have been fascinated by picture projection. While schools continued to use this device for instructional purposes it lost favor as home entertainment and as an exciting means of expression for the amateur photographer. Now, however, due to the advent of natural color films, still projections are beginning to enjoy a rennaissance. Projectors are being set up in the parlor and the family is again gathering to view itself and the places it has been. Even the monotone slide may win itself back to favor under the stimulus of color transparencies. Beautiful 3¼ x 4 inch standard size slides can now be made directly from full color Kodachrome by using the 2¼ x 3¼ or larger cut film, a tremendous advance over the old hand-colored slide. At this size Kodachrome can be economically used since single shots can be planned on separate film.

Photographers may do well to rediscover the slide. Aside from its use in instruction, the positive transparency has certain inherent values for photographic expression. The lantern slide may have a tone gradation of 1 to possibly 300 or 400 as compared with paper prints which may range from 1 to 20 or 30 for matte and 1 to 40 or 50 for glossy prints. This accounts in great part for the qualities of the projected picture. With a greater range of tone gradation, the well-made slide will show full tonal luminosity of detail even in the areas of blackest shadow; the projection offers greater feeling of the third dimension in the increased sense of depth and luminosity.

The value of the slide as a form of visual education lies in its use for group instruction. When projected on the screen its size permits it to be seen from various distances by several people. Furthermore, there is an advantage of an emotional heightening of interest. As in any picture show, in a darkened room the observer tends to lose contact with his immediate physical environment and becomes absorbed in the play of light and shade on the screen before him. The most success-

ful and welcome tests the writer has given have been those in which lantern slides have been used; for one thing students enjoy the game of identification. A series of slides can help create the illusion of reality, and learning can be intensified: the succession of vivid images helps bring out sharply interrelationships, contrasts, comparisons or step by step continuity.

The standard American $3\frac{1}{4}$ x 4 inch lantern slide is still the one most frequently used in schools and colleges. The advantages of its size in projection and the qualities of its projectors in addition to the large libraries and collections already accumulated have made it standard equipment for the classroom. Its size permits the use of larger negatives and a wide range of treatment in detail and in tonal control.

Obviously the advantages of the lantern slide will be lost if the slide is poor. The following will affect the quality of a slide:

1. DENSITY AND CONTRAST: Average density will depend on exposure and should be determined with a view to the illumination to be used in projection: average density should be less for comparatively weak light and greater when high power light is used. Contrast will depend on development: the longer the time of development the greater the contrast will be up to the point where the plate becomes too dense.

39. MAKING PAPER FROM CLOTH. One of the numerous picture series published in the Journal of the National Education Association, and prepared by the Visual Education Department of the Santa Barbara City Schools. The picture series forms a very important educational help.

A slide will have too great a contrast when the black areas do not transmit light or when the white areas are bare glass. At both these limits, detail is lost.

2. COMPOSITION: The composition may be affected by the size of the projection, and should be thought of with the large size in mind. Remember that the defects of the small plate are magnified on the screen. Too large an area of white may produce reflections back on the screen and tend to destroy the rest of the image and make it more difficult to view the succeeding image; an excessive amount of black area may cause the image to appear dim. In either case the clarity of the projection is lost. Other defects of composition may be a confused background; too small an image in proportion to the frame, leaving too great an area of clear glass; poor lighting used in taking the picture so that it is difficult to read detail and texture; lack of emphasis on the essential idea of the picture so that attention may stray during the showing of the slide: poor masking, producing disturbing irregular shapes on the screen; fuzzy light edges that weaken the effect of the projected image.

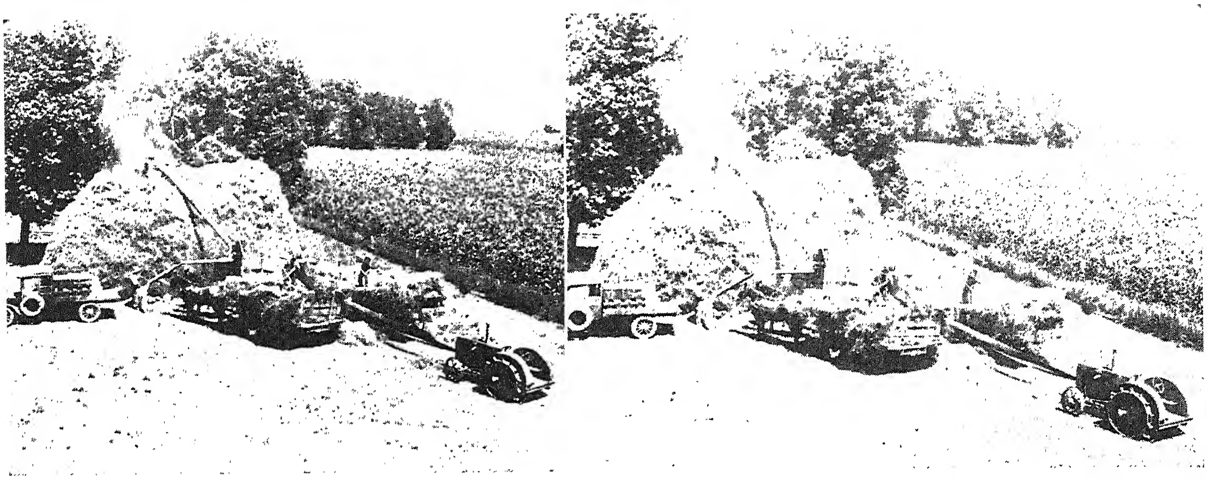
3. CHEMICAL AND PHYSICAL DEFECTS: Imperfections in the negative and the lantern plate—pinpoints, scratches, blemishes, light streaks, fuzziness and thin contrasts—will be embarrassingly magnified many times when the slide is projected on the screen. Chemical stains, melting gelatin due to overheating, dewing produced by excess moisture or inadequate drying, thumbprints in the emulsion, and other defects can be avoided by exercising the care necessary in any photographic procedure.

Making Slides

The first important step in making a slide is in producing a fine negative. While it is possible to do an appreciable amount of touching up on a print or even on a negative for a print, there is relatively little that can be successfully done on a negative for a slide or the slide itself. This is not merely a question of clever handwork but one of the magnification of error in the projection on the screen. For the same reason, the negative should receive extreme care in mechanical matters of handling, development and preservation, and in pictorial problems of composition, lighting and detail.

1. LANTERN PLATES. Two types of plates are in general use, a) fast, for making plates by projection or reduction, b) slow, for contact work. The slow plates are sometimes used for extreme contrast and special plates are produced for this purpose and also for warm tone slides. (General practice in this country is confined to black tone slides.)

2. SLIDES BY CONTACT. This method makes use of the same type of equipment as that used for making contact prints and may therefore appeal to the beginner. Aside from exposure and development, results will depend a great part on the



40. GOOD AND BAD PHOTOGRAPHS. Correctly printed photograph at left; poorly reproduced picture from exactly the same negative at right. Loss of detail and true tonal values may lead to serious misinformation. The picture at the right fails to convey the story clearly. It is almost impossible to make out what all the figures are doing and the impression of the grain and the tree foliage can, at best, be only vague. Compare the right view with the same view at the left which brings out all of the rich detail and produces truer interpretive values.

quality of the negative. Two main precautions should be followed: a) There should be good even contact between negative and plate and the printing frames should be handled so that there is no slipping between the two, especially when they are of different sizes. b) Relatively small amount of light in exposure should be used and the frame kept sufficiently far from the source to avoid bad spotlighting. Use a frosted bulb to prevent the image of the bulb filament from showing on the slide. And watch out for dust.

3. SLIDES BY REDUCTION. Slides made by projection, usually by reduction, offer the best results. In projection the possibility of control in exposure is such that good slides can often be made from indifferent negatives. There is the possibility of light control in dodging, in compensating for thinness or density of negative as well as the possibility of better composition. A large negative may provide a better chance for retouching or selection and definition of detail than a small one. There is also the advantage of using either a wet or dry negative. The method is simply one of photographing a negative on a lantern plate, using the special camera made for the purpose.

4. EXPOSURE, DEVELOPMENT AND TESTING. The temptation is strong to rely on guesswork and simple inspection. One reason for this is the fear of the cost of testing, but experience proves that it is far more economical to use one plate for trial exposures rather than several for mistakes in guessing.The method is simple: Hold a card in front of the frame leaving only a narrow strip of the plate exposed to the light. After an exposure of one second, move the card to expose another strip of one half or one inch and use another second of exposure. By repeating this process, there will be a series of strips showing exposures of one to four, or more, seconds. (Two or three second intervals can be used.) The strip giving the best results can then be chosen for the exposure time of the final slide. For the sake of economy and where time may count, similar testing can be made by using photographic paper. With practice, a scale of conversion factors can be established to make adjustments between the paper and the slide plate in matters of density and tone values. Test paper can not only give the necessary information with regard to contrast and exposure but these tests on paper can be preserved to make up a print reference file for the slides.

5. OPAQUING. It often becomes necessary to remove pinpoints and scratches from the negative as well as block out some of its areas. A form of rouge paste applied by a small hairbrush is used for this purpose. It is also possible to treat the negative by airbrush work to grey down backgrounds and get special effects in composition. All such treatment, however, is very delicate.

6. EXPERIMENTAL POSSIBILITIES. Many unusual and interesting effects can be obtained by color tone development, by physical development, by reduction and intensification, and by local brush development. There is also the possibility of reversing images; one practical application being in slides which show graphs, charts, or line drawings, the white lines on black background being more easily read.

7. MASKING, BINDING AND IDENTIFICATION. The slide is not ready for use until the image has been masked, the slide covered with a thin glass plate, bound and then identified. Standard masks of various sized and shaped openings can be purchased but it is usually more flexible and practical to use narrow black masking tape such as that used to bind the slide and the cover plate together. Standard identification tags and spots are also obtainable. The spots are used to indicate where the slide should be held for insertion into the slide carrier

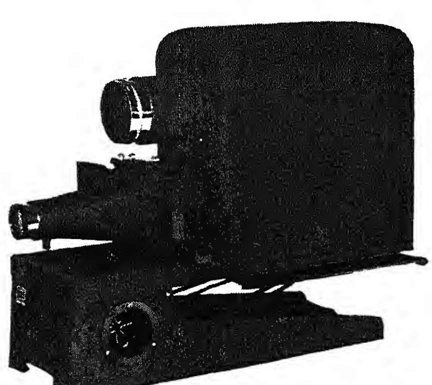
of the projector. Finally, slides should be kept clean and filed.

Projection

Many of us know the let-down experienced when the projector in a motion picture theater breaks down in the middle of a picture. We became so lost in the projection on the screen that such an intrusion jars us and may effectively destroy our interest. The same is true in slide projection. The audience should be kept totally unaware of the mechanics involved. The success of a lecture may well depend on the smooth flow of images on the screen and on the sense of continuity produced by proper and well-planned handling of the projector. The show will depend on the room, the projector, and the screen.

The projection room. The room should be arranged to permit proper seating and sight lines and proper lighting—which usually involves darkening the room unless a daylight screen is used—so that there will be full opportunity to study the projection without strain or discomfort. Natural color films require a completely dark room. A rectangular room is generally best for good vision and acoustics with average length 1½ times the width. Seats should come within an angle of 40 degrees from the center of the screen. Seats too near, too far, or too far off to the side, strain vision and hearing, cause distortion and uneven reception. Minimum distance of first row to the screen should approximate the width of the screen, maximum distance of last row should approximate 5½ times the width of the screen. The projector should be located so that the audience will not step into the projected beam of light. The vertical angle from the eye to the top of the screen should not exceed 40 degrees.

The projector. The lantern should provide sufficient illumination, sharp screen focus, proper projection size, and ease of operation. Chief difficulties come with dusty condensers, faulty lenses and slide carriers. The problem is chiefly one of maintenance. Since electricity is used everywhere, plugs and connections should be checked, and wires and coils kept out of the way. *Preparation* is the best advice that can be given for the use of the projector. In actual operation, each slide should be in proper order, there should be a minimum of operating noise, and the showing of blank exposure of the white screen between slides should be avoided. There are various ways to signal the operator. The best is a small red-signal light at the lantern which is controlled by the lecturer. Double lanterns, or "bi-unial" lanterns for dissolving views, revolving and magazine carriers, are some of the devices which are occasionally used to facilitate the showing of slides. Care should be taken about showing the slide right side up.



41. This Baloptican LRM is a combined lantern slide and opaque projector, manufactured by Bausch & Lomb Optical Company, Rochester.

The screen. There are two main types of screens. Opaque screens are used for *reflecting* the image, translucent and daylight screens for *transmitting* the image. Opaque screens may be the whitened wall of a room, metallized surfaces, a brilliant bead screen, or more commonly, a special prepared fabric which properly diffuses the light for a good reflection. Translucent screens can be made of sanded or ground glass; metal gauze or muslin; tracing paper or tracing cloth; or commercial daylight screens. The size of the screen should be large for the sake of flexibility but it is important that the image should not occupy less than half of its area so that too much white space will not be left as distraction.

Outside the Classroom

The modern educational institution has come to recognize the values of co-curricular work. It has had to recognize that there is a social aspect to the life of students while in school and that they should be provided the opportunity to train themselves in the duties and activities of that social life, that they must be given training and experience in those areas not subject to formal or traditional instruction. There has thus developed on the campus counterparts of society itself, such as news reporting, to name but one of many. Students now run fairly high ambitious publications—newspapers and school annuals. They seek to record the interesting and important events of their life while at school, and this includes, not only the athletic events, but other passions as well, and, in some cases where they publish professional or other serious periodicals, their studies. There is hardly a student publication office now that does not have or does not feel the necessity of having a battery of cameras to record photographically one form or another of their school life. Today students can be found with their professional brethren in journalism on the

sidelines of the football gridiron or shooting some newsworthy event elsewhere on the campus.

This work is of course essentially news photography and students will inevitably follow the practices of professional news photographers in their choice and use of cameras and in the taking of pictures. More and more they seek the thrill and power of getting good photographs that tell their story cleanly and unerringly; they are no longer becoming satisfied with snapshots. In other co-curricular experiences there is a corresponding development of precise and worthwhile documentation. The school is turning increasingly to the local resources of the community itself for the raw materials and problems of learning and teaching. On field trips and school journeys, in extramural work of all sorts, students are training their cameras on the significant subject and the significant detail.

Public Relations And The Camera

Still another expression in education should be noted: the relation of the school and the school system to the public. There have recently appeared several excellent reports in various cities, New York, Los Angeles, Detroit, Buffalo, and elsewhere, volumes well documented with photographs showing what the schools are doing. One phase of this needed public understanding is illustrated in the work in Santa Barbara previously described by Mr. Noel. When it was desirable to report the new curriculum plan to the parents, it was not altogether satisfactory to make this report a heavily worded document, full of technical terms and educational jargon. It was evidently preferable to photograph the new curriculum in practice. The result was to give a better and more refreshing understanding of what the schools were doing and what was happening to the pupils. These photographs present not only pupil and school activities and accomplishments but they reflect the use of modern tools of education such as the camera, as well as new attitudes of human interest in contemporary education.

Documents, School Camera Work, And the Photographer

When the documentary nature of the photograph is recognized and understood it is the task of education to accumulate such documents. It will have to create visual resources especially in the school production of photographs. When it understands the potentialities of the camera, its availability and its effectiveness, it will confront two major challenges. First is the collection and utilization of such documentary evidence. Second is the problem of training in the use of the tool: Just as training is needed for the acquisition and use of verbal language so must there be training in the skill and use of the visual language of photography, training in making and using Graphic documentation.

The theory and practice of visual education, so important to the teacher, contain lessons for the photographer whose "teaching" may be outside the school. His work will gain in effectiveness if he will, like the teacher, think of his audience, considering how he can best put over his story by the way he handles details, textures, and tones. To do this he must take account of the documentary approach both in his search for subject and in his technique of shooting. He must use the camera for more than capturing images on paper and film but also as a means of conveying his vision and understanding to others. When he does this he will be making his photography not merely a series of snapshots but a thrilling record of his world.

Preparing Visual Education Materials With the Graflex Photorecord

The following information was prepared by D. F. Noll of the Folmer Graflex Corporation.

In addition to the use of Graflex and Speed Graphic cameras in the preparation of photographs for visual materials there is the Graflex Photorecord which is finding valuable use in many institutions and laboratories. The Photorecord is fully illustrated in the Documentary Reproduction Chapter by Vernon D. Tate. Additional information related to the production of visual education material is given in this section.

Film slides as well as the regular lantern slides have a permanent place in teaching methods. With the Photorecord outfit it is possible to make any combinations of pictures by copying directly on the 35mm Microfilm in various lengths. Skilled operators are not required to operate the Photorecord.

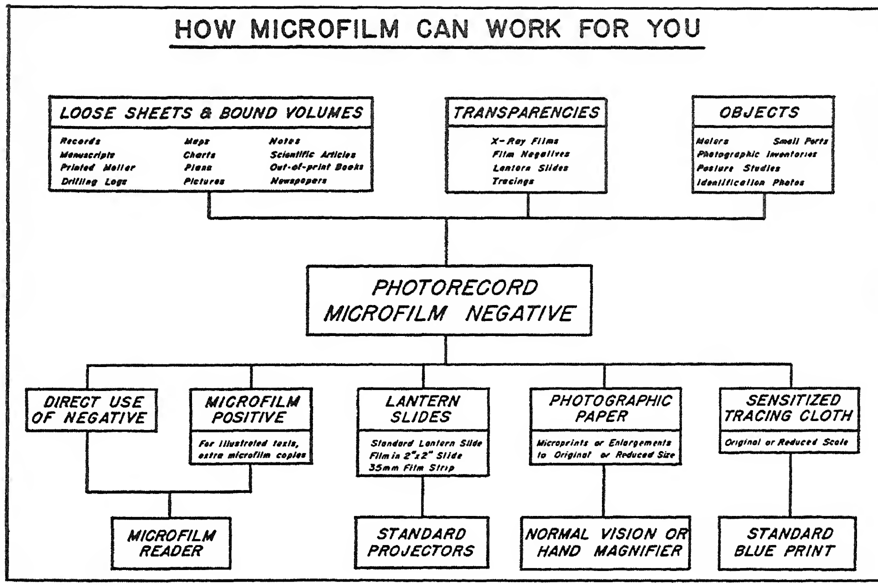
Briefly summarized, the Graflex Photorecord Microfilm camera offers to workers in the preparation of visual education material the following features:

1. *Low labor cost* with rapid, semi-automatic camera action.
2. *Low material cost* by using bulk 35mm film.
3. *Low investment cost* by sharing its use with various departments.
4. *Extreme versatility* . . . single or double frame 35mm film, $2\frac{1}{4} \times 3\frac{1}{4}$ cut film, and "optical" printing of positives.

Microfilm in School Departments

In the smaller school systems or colleges where the volume of tailor-made visual material may be small, the following well-recognized uses for Microfilm equipment will indicate some of the other school departments which might be interested in sharing in the use of a Photorecord camera and its accessory equipment:

1. Student photos.
2. Registrar's transcripts.
3. Condensed school records.
4. Transcription of "Descriptive Grades"



42. Classified grouping to show how Microfilm as used in the Photorecord can be applied to various purposes.

5. Thesis publication on Microfilm.
6. Posture studies for Physical Education Departments.
7. Inter-library loans on Microfilm or enlarged paper prints.
8. Extension of the library's holdings in specific fields by students or faculty.
9. Microfilming bound newspaper volumes.

Several specific examples will indicate some actual uses of the Microfilm method.

One school reports saving the cost of one full-time typist while using a Photorecord camera to copy the instructor's comments on each pupil's work under the system of "descriptive grading" recently adapted. Under this new system the student is given the instructor's original comments, usually written in long-hand. The only record of the student's "descriptive grade" is the Microfilm copy which can be stored in about 3 per cent of the space which would have been required by the original or transcribed copies on paper. Another example is the possibility of space saving in school record-keeping. It was found that because of the number of blank pages in each bound school register, 16 registers, a little more than one inch thick could be preserved on one roll of Microfilm. Social security registration created frequent requests for information contained in these registers. As the school registers were scattered throughout each school in the entire system the establishment of a central record depository was indicated. The space saving in this case may be summarized as follows:

	Dimensions	Cubic Inches	Per cent of Original Space
16 school registers	9 x 12 x 18 inches	1944	100.0%
1 roll of Microfilm	4 x 4 x 1½ inches	24	1.2%

The advantages of Microfilms do not end with savings of 97 or 98 per cent of the storage space required. There are also savings in the cost of locating records and maintaining files in their proper sequence. "Once in proper order, always in proper order," is the unalterable rule of Microfilm files.

How Microfilm Can Work For You

The accompanying table gives a clear organization of the various applications of the Photorecord Microfilm equipment. Copies can be made from either negative or positive originals. The most common, of course, is to copy from positive materials such as photographs and line drawings. However, the possibilities of copying lantern slides and film negatives by transmitted light should not be overlooked. Once the proper exposure has been determined by test, 35mm negatives of lantern slides may be made at the rate of 500 or more copies per hour. Positive copies of original film negatives are free from undesirable "paper grain." When black and white materials are being copied, the use of bulk motion picture positive film will greatly reduce the cost of film material.

What is the Graflex Photorecord

A very complete description about copying all types of materials has been given in the next chapter by Vernon D. Tate. However, a brief description of the Photorecord equipment is of value at this point.

The Graflex Photorecord camera will accept two sizes of film material—the 35mm and 2¼ x 3¼ sheet films. The magazine will accommodate 100 feet of 35mm film on daylight loading rolls, but shorter lengths may be removed from the magazine in the darkroom as required. The 2¼ x 3¼ sheet film may be loaded in sheet film holders or magazines which are available with suitable focusing panel as accessories.

The Graflex Photorecord is designed to operate by air pressure. Pressure on a foot pedal forces air through a rubber tubing which first advances the film and then actuates the shutter. This leaves the operator's hands free to change the material being copied. The average speed of operation may be estimated at 500 exposures per hour provided the material is reasonably uniform in character and size. The size of the material copied may vary from that of a common postage stamp to a single newspaper page. Even larger material, such as engineering drawings, may be microfilmed provided the legend is not too fine. At the higher reductions required for newspaper microfilming, special arrangements must be made to secure even illumination and freedom from vibration.

The developing and printing equipment recommended for Microfilms is discussed in the chapter on Documentary Reproduction; however the following equipment check list will be of special value to give a better idea of the entire Photorecord outfit.

PHOTORECORD EQUIPMENT CHECK-LIST

	Minimum Essentials Visual Education Material Only	Add for Documentary Microfilming	Other Optional Equipment
Basic Equipment, TOTAL	$475.00	$66.50	$ —
1 Graflex Photorecord	295.00	—	—
1 Book Cradle	—	60.00	—
1 Extension Arm for above	—	6.50	—
Filters K-1, K-2, K-3	—	—	ea. 2.75
Filters A, F, G	—	—	ea. 2.75
1 Motor Driven Compressor AC	—	—	50.00
1 Right Angle Bracket	—	—	6.50
2 Wall Brackets	—	—	14.00
1 Stineman Developing Outfit	70.00	—	—
1 Stineman Drying Rack	—	—	10.00
1 Stineman Printer with Motor	110.00	—	—
1 2¼ x 3¼ Graflex Focusing Panel	—	—	5.00
1 2¼ x 3¼ Graflex Cut Film Holder	—	—	3.50
1 2¼ x 3¼ Graflex Film Magazine	—	—	13.00
Miscellaneous Dark Room Equipment, TOTAL	$ 11.70	$ —	$19.75
1 Eastman Safelight Lamp	3.00	—	—
1 Eastman Measuring Jug	1.50	—	—
1 Eastman Thermometer	.90	—	—
6 Kodak Jr. Film Clips	.60	—	—
2 Cellulose Sponges	.70	—	—
1 Light-Tight Film Changing Bag	5.00	—	—
1 Rubber Laboratory Apron	—	—	2.00
3 Trays, 11 x 14 inch	—	—	3.75
1 Print Washer	—	—	8.00
1 "Rapidry" Print Dryer	—	—	6.00

Complete information about the operation of the Photorecord equipment is given in the special Photorecord Working Manual which is available from the Folmer Graflex Corp.

With the increasing use of color films in all types of visual education work our concluding paragraphs will give a few important essentials. Additional information may be found in the complete chapter describing Kodachrome.

Copying In Color With Kodachrome

Type A 35mm Kodachrome is available in 15-foot rolls for use in the Photorecord magazine. Professional Kodachrome in 2¼ x 3¼ inch sheet film sizes is available for use in Cut Film Holders or the Graflex Cut Film Magazine.

The copying in color of illuminated manuscripts, color engravings and original paintings is, therefore, possible with the Graflex Photorecord camera. The use of Photoflood bulbs for illumination by reflected light is well adapted to use with the Type A Kodachrome. The copying of Kodachrome transparencies by trans-illumination cannot be satisfactorily accomplished with Type A Kodachrome. Contrast is greatly increased by transmitted light, and a color-sensitivity balance acceptable for reflected light is unsuitable when transmitted light is used.

DOCUMENTARY REPRODUCTION

VERNON D. TATE

In recent years photography has played an increasingly important role in human progress. Documentary reproduction is one of the most important phases of modern photographic activity. It is not primarily concerned with photography as an art but rather with photography as a science. The aim of documentary reproduction is to achieve an accurate representation of a documentary original. Although the dictionary may not offer unqualified support, for present purposes a document may exist in many formats, such as a photograph, drawing, painting, carving, manuscript, coin, printed book, or an inscription. Strictly speaking, a document should contain writing, printing, or some other textual matter, yet in recent years the tendency to include graphic and artistic material in the documentary classification is more and more evident. A startling example of the use of photodocumentation may be found in popular picture magazines which utilize a minimum of words and depend on photography to tell a story. In this discussion, attention will be concentrated on the kinds of documentary materials commonly encountered in archives, libraries, museums and in private collections.

The Original

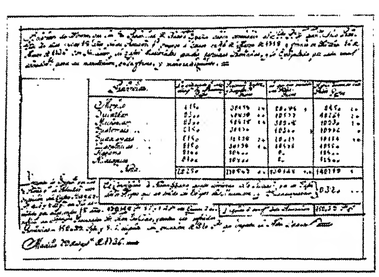
That which is to be reproduced is the original. It has been found convenient to classify documentary originals under six headings:

I	Manuscript	IV	Full tone
II	Printed matter	V	Gross objects
III	Line originals	VI	Composite

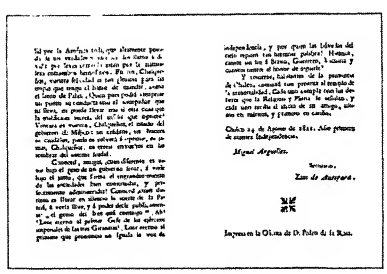
A manuscript means, literally, handwriting in pencil or pen and ink on paper or a similar substance, or even typewriting.

Printed matter comprises originals which have been produced by a technique of printing, whether the standard letterpress, offset, or other methods have been used.

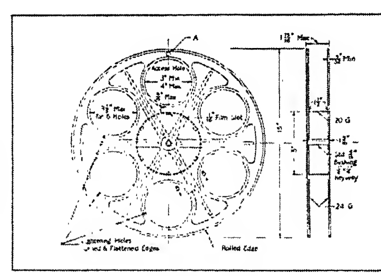
Line originals are closely allied to the two preceding, but are segregated by their composition, which is essentially lines of varying thickness and shape. They require special treatment in documentary reproduction. Architects' drawings,



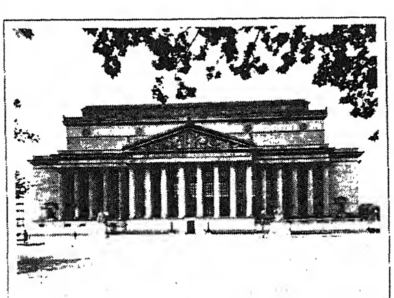
CLASS I MANUSCRIPT



CLASS II PRINTED MATERIAL

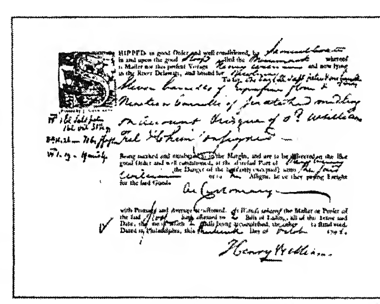


CLASS III LINE COPY



CLASS IV FULL TONE

CLASS V GROSS OBJECT



CLASS VI COMPOSITE

Illustrations showing the six different classifications of documentary originals as described above.

wiring diagrams, engravings, and the like are usually represented as line originals.

Full tone originals are those with a long scale of tones to be reproduced. These tones may be distinguishable to the human eye in the form of color, as in a painting or a color photograph, or they may be in monochrome, as in an ordinary photograph.

Gross objects are those having three dimensions: length, breadth, and thickness, which must be taken into account in the making of a reproduction. It is true that all originals mentioned have three dimensions, but for practical purposes the first four have only two, as thickness is not important. Low relief carvings, coins, seals, archæological specimens, museum artifacts and similar originals, however, have been grouped for convenience under the heading of gross objects. The last classification is that of **the composite original,** which is one incorporating two or more of the foregoing. An example of a typical composite might be a filled-out form in which manuscript, line work and printed matter are combined.

The value of classifying originals to be reproduced is evident at once. Certain originals require far different treatment than others. By classification and segregation the reproductions may be made with ease and economy. If no organization, or a haphazard one, is attempted, the results may be costly in time and in materials.

Kinds of Copies

Just as there are several kinds of originals, there are several kinds of copies which may be made from them. In the process of classification it is possible to list these as:

1. Full tone
2. Contrast
3. Corrected
4. Color

A full tone copy is one in which the same relative tonal values present in the original are preserved in the reproduction. An accurate copy of a long scaled photograph should match as nearly as possible the characteristics of the original. **A contrast copy,** on the other hand, is an attempt to secure the greatest amount of separation possible between text and background or between portions of the original. A contrast copy of a printed page would show the black printing as black as possible, and the white background as white as in the original. **A corrected copy** is one in which certain characteristics present in the original are deliberately removed or intensified for a special purpose. If a photographic print has been disfigured by a yellow stain, it is sometimes possible to remove the stain and reproduce the print as though it had not been affected. It was once the custom to censor printed books by obliterating passages. As the censor's ink was usually different from that in which the book was printed, it is sometimes possible to make a corrected copy of a text which will remove most of the censoring ink, and will allow the underlying printed matter to be read. **A full color copy** may only be made of a colored original, and is intended to be a reproduction as seen by the human eye.

Essentials for Photographic Reproduction

What are the essentials for photographic reproduction? In reality they are surprisingly few. A camera, sensitive material, light, a means of processing and printing, or otherwise using the completed copy, an original or originals to copy, and sufficient knowledge to combine them in order to produce the desired result complete the list of requirements. The cost of equipment may be very moderate or may represent an investment of many thousands of dollars. The aims, requirements, ingenuity, and pocketbook of the prospective operator will determine the extent, and costly equipment is no guarantee of success. Results achieved with simple and low-priced equipment in careful and expert hands may vie with the products of professionals with the newest and best equipment and accessories. The essential differences between professional and amateur in documentary reproduction are those of aims and production requirements. A professional, in order to survive, must reproduce varied originals in quantity, economically, and subject to certain time limitations. The amateur usually produces far less and may restrict his attention to originals possessing a personal appeal. To him, time is not necessarily of prime importance, yet economy must always be considered.

The Camera

Any well constructed camera of advanced amateur or professional grade will be suitable for first class documentary reproduction. Obviously, the better the camera, lens equipment and accessories, within certain limits, the better the results. There is a point, however, when an additional investment would serve merely to increase the facility and speed with which copies may be made without adding materially to the excellence of the final result.

In general, the preferred conventional camera for work of this kind is a stand type apparatus with a rigidly constructed and accurately machined framework, a long bellows extension (long enough to accommodate the lenses being used for accurate scale work), a ground glass focusing screen, an iris diaphragm, a good shutter with a cable release, and a supply of film, or plate holders, or a device to hold other sensitive material.

The lens should be anastigmatic, fully corrected, and of as good quality as possible. A "process anastigmat" will pay real dividends in quality of work, although the initial investment may be rather high.

The film size used is most important to the professional using a large amount of film. Most professionals prefer 8 x 10-inch or 5 x 7-inch standard sizes, while some require cameras with capacities up to 20 x 24 inches and even larger. The amateur in recent years has displayed little interest in cameras larger than 4 x 5 inches, and these, together with the 3¼ x 4¼ and smaller sizes, are in general use. Except under extraordinary conditions, satisfactory reproductions may be

REPRESENTATIVE GRAFLEX CAMERAS

CAMERA	NEGATIVE SIZE [IN INCHES]	COPYING STAND	USED BY
Century Universal	8 x 10 [adjustable to other sizes with accessories]		Professional
Crown Enlarging Reducing Copying Camera	8 x 10 [adjustable to other sizes with accessories]	Crown Laboratory Stand	Professional
Crown View Graphic View Camera	4 x 5 [Reducing back to 3¼ x 4¼ available]		Amateur and Professional
Fingerprint Camera	2¼ x 3¼	none required	Professional and Amateur
Graflex	3¼ x 4¼, 4 x 5 5 x 7	Variograph	Professional and Amateur
National Graflex	2¼ x 2½	Variograph	Amateur
Photorecord	35mm double perforated ciné film single frame ¾ x 1 inch (approx.), double frame 1½ x 1 inch (approx.) and 2¼ x 3¼	Copying Stand built in	Professional and Amateur
Speed Graphic	2¼ x 3¼, 3¼ x 4¼ 4 x 5, 5 x 7	Variograph	Professional and Amateur

made with these smaller cameras, if care is used in manipulation.

It may be desirable at this point to survey a standard line of photographic cameras for the professional and the amateur. The accompanying table of equipment available from the Folmer Graflex Corporation has accordingly been compiled.

It should not be inferred from the foregoing that copying cannot be done with equipment other than that listed above. Quite the contrary is the case. The Folmer Graflex Corporation, however, does offer a good selection of dependable cameras in almost any price range and capable of meeting practically any requirements. The information here given is equally useful with any good camera if suitable allowance is made for individual differences.

2. CROWN LABORATORY STAND. This rigid support is available for all types of copy work. There is a movable camera platform for easy focusing.

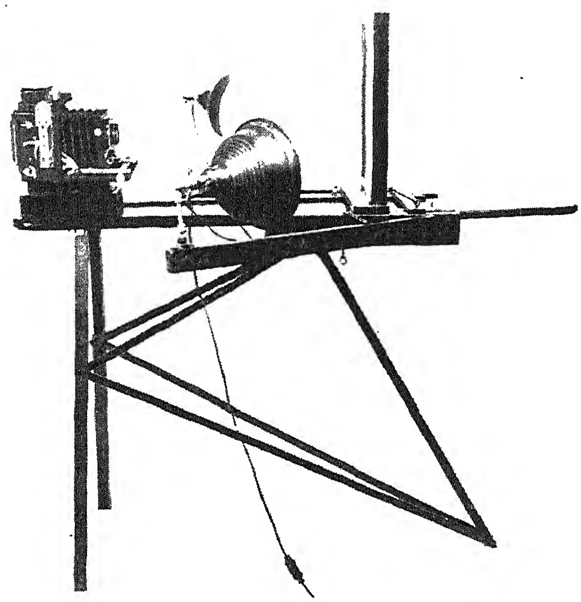
The Copying Stand

The copying stand is essential in documentary reproduction. It holds the original and the camera in certain fixed relationships, and permits reproduction with the utmost facility. One of the vital considerations in documentary reproduction is the maintenance of the original and the sensitive material in the same plane and parallel to each other. A copying stand assists in reaching and maintaining this relationship. It must be versatile in order to accommodate originals of varying sizes, but must also be rigid in order to eliminate vibration—the bugbear of documentary reproduction.

There are two general types of copying stands which may be considered: the horizontal and the vertical. The horizontal stand is one which is operated on the horizontal plane. The original, for example, may be pinned or affixed on a vertical copy board or on a convenient wall, while the camera on a stand is focused and adjusted laterally with the film in a vertical position to the floor. This may be illustrated by the Crown Laboratory stand, which is frequently used in this position, although it is universal in that it may be swung into the vertical position as well. The horizontal position is characterized by the placement of the original and the film parallel in a position vertical to the floor. The horizontal position has persisted through the easy accessibility of the camera and the copyholder for loading and manipulation, and is most frequently employed with the larger cameras. The vertical position causes the camera to be elevated above the copy, which is placed on a copy board. The Variograph is a stand of this type. The vertical position is extensively employed in microphotography and

in the reproduction of small objects in quantity, particularly with 3¼ x 4¼-inch or smaller film sizes. It is very convenient for handling large numbers of medium size originals and for obtaining special effects, which will be discussed in detail later.

The custom of using tripod stands for reproduction has now happily become almost extinct. A tripod is none too steady, even when equipped with a tripod brace, and, when a slow film combined with a small diaphragm stop is used, good reproductions are quite difficult to secure. Its use should be reserved for emergencies.



3. COPYING STAND . . . for objects mounted on a sliding wooden block which provides rough focusing positions. Fine focusing can be done with the camera adjustments. The entire copying stand is made from a typical folding ironing board. Camera can be raised or lowered by placing blocks of different sizes underneath. Also the two side lights can be swung out or in for illumination adjustments. Designed and built by Frank W. Ballard.

It is quite easy to improvise a horizontal copying stand from a sturdy table which has been tested in the lateral and transverse planes with a level. The legs may be shimmed with paper or cardboard to make it level and steady. A few books or a board will support the camera, and a convenient wall space which is at exact right angles to the camera serves as the copy board. If much copying is contemplated, the acquisition of a copying stand is highly desirable. Vertical copying stands may also be easily constructed from pipe and fittings.

The copyholder may require modification to equip it for loose sheets, bound books, gross objects, and the like. This modification will be considered in detail.

Light

Light is one of the most important ingredients in documentary reproduction. It is of two types, natural and artificial. Natural light is one of the finest known photographic illuminants, yet in use it is not very dependable. It varies from minute to minute, hour to hour, and season to season. The variations include intensity and spectral composition. However, if the uses and limitations of natural light are fully understood, it may be employed to considerable advantage in documentary reproduction. In some locations it is the only possible illuminant. Some observations on the use of natural light will be included in the discussion of illumination.

Artificial light, by reason of its dependability and ease of manipulation, is used by practically every professional and by most non-professionals. Aside from certain special applications, there are three principal types of artificial light in common use: tungsten lights of various types, mercury vapor lamps, and electric arcs. The latter are used principally by professionals and need not be considered further at this point. Tungsten and mercury vapor illumination is far more common and for most purposes fully as satisfactory as arc lamps, and much cheaper. The ordinary frosted tungsten lamps, sold for household illumination, are quite satisfactory. The photographic photoflood lamp is also widely used. It is a special type bulb intended to operate at about 66 volts. By being used on standard 110-120-volt circuits it produces much greater light emission at a corresponding sacrifice in burning time. Blue "daylight" tungsten bulbs have been placed on the market, but their use has not been uniformly satisfactory, as the matching of bulbs is quite difficult. Some of the newer blue bulbs are said to overcome this difficulty. Tungsten bulbs are available in many special sizes and forms which the average amateur, or even professional for that matter, does not appreciate or employ. There are, for example, 105-115-volt, 15 and 30-watt candelabra base lamps which are about the size of an ordinary automobile head lamp. These may be used to great advantage in constructing lighting apparatus. Another even more recently developed light is the 100-watt, 105-115-volt lamp, also the size of an ordinary automobile head lamp, with a single contact tubular automobile-type base. These lamps may be secured from any dealer with a complete stock of "ornamental" light fixtures. The tubular showcase lamps known as "lumiline" lamps may also be used to advantage in particular cases. They may be obtained inside frosted or in some cases in colored glass.

In the field of mercury vapor illumination, however, great strides have been made in recent years. Many people associate mercury vapor illumination with the long Cooper Hewitt tubes which have been standard equipment for many years. While these long tubes are

still in use, the newer high intensity mercury vapor lamps have become more popular. Small glass bulbs less than six inches in length by about an inch in diameter emit 250 watts of highly actinic light, while a slightly larger size will deliver approximately 400 watts. Two additional developments are still so new that their applications are in the initial stages. The first of these is the **fluorescent mercury vapor lamp** which is tubular in shape and similar in appearance to the "lumiline" mentioned above. The inside of the tube is coated with a fluorescent material which determines the spectral emission of the lamp. One style in particular, called the "daylight," has a spectral range which is very near that of natural daylight. It is very useful in color work. The second development is the **high-pressure mercury vapor lamp** which possesses the incredible power of 1,000 watts in a concentrated burning area of only 24mm. The light itself in its quartz jacket is no larger than an ordinary cigarette, and is less than five inches long. The power of the light is such, however, that it must be water cooled and about six quarts of water must be passed through its water jacket per minute to keep it from exploding. In its present stage of development, the lamp is being used in industry experimentally, but its cheapness and tremendous potentialities will adapt it for many other uses. No one should attempt to use this lamp, however, without understanding it thoroughly, for serious physical harm might result from improper use.

Neon and other gas-filled vapor type lamps have been used to some extent in documentary reproduction. In general, their wattages are low and the color characteristics of the tubes limit widespread application. The principal advantage lies in the extreme ease of fabrication and low cost brought about by extensive use in advertising. With some kinds of originals and reproductions, particularly if a large number of similar originals are to be reproduced, the investment in a specially constructed system might be desirable. A small card copying machine, for example, uses a U-shaped neon lamp.

While it seems that the serious amateur and the professional may eventually come to rely upon mercury vapor lamps as standard equipment, their common adoption may be hampered by several factors. In order to reach full intensity, these lamps may require as much as nine minutes heating time, and may not be relighted until they have cooled somewhat. They cannot be turned on and off, except by shutters operated before the constantly burning lamp. Certain accessory equipment, namely, resistances for direct current and transformers or reactors for alternating current, must be used. This increases the cost of the entire unit. The bulbs themselves are more expensive than tungsten, although they are somewhat cheaper to operate than equivalent wattages in tungsten lamps.

Illumination

Illumination, or the application of light to an original, to secure a desired copy is best learned by experiment and experience. There are, however, certain basic principles which are essential. The first of these is to **match the light source to the original,** the type of reproduction desired, and the sensitive material being used. If a colored original is reproduced and a full tone copy is desired, the light and film must be such that the reproduction will appear in monochrome with the colors represented in approximately the same relationship as seen by the human eye. With an original requiring panchromatic film, blue violet mercury vapor illumination is undesirable as this light is deficient in red, hence the red sensitivity of the film is lost. A better illuminant for work of this type would be tungsten lamps which are rich in red light. The second factor is that of **uniformity.** This is highly important for balanced reproduction. If one sector of the original receives more light than another, the reproduction will be unequal and poor in quality. The third essential is **avoidance of reflection.** If the original is covered with glass, it must be observed carefully in the camera ground glass in order that reflections will not spoil the reproduction by introducing

4. GRAFLEX PHOTORECORD IN ACTUAL USE. Note position of documentary material, illumination, and the operating foot switch.

white spots and streaks (on the negative) which show up in the print as black streaks and spots. Great care should be exercised to locate ceiling lights or any others which might cause reflection or unequal illumination. These may be located quite easily in the camera ground glass or by placing a small mirror at an angle of 45° before the camera lens and viewing the image in the mirror. The mirror may be used to advantage as a final check when the camera is loaded and ready for the exposure. The fourth point deals with **light placement.** It is usually desirable to illuminate the documentary original from two or more sources. Angular illumination from a single source will bring up any grain in paper or other original, and may also cause shadows which it is almost impossible to eliminate.

When daylight is used, north light is to be preferred, as it is more constant and diffused. Under no circumstances should direct sunlight be employed. It is sometimes difficult to secure even illumination with natural light, hence it is customary to use reflecting screens to equalize the light over the area being reproduced. These screens may be made of cloth, paper, or other material. A piece of fluffless blotting paper, such as that used for drying prints, is sometimes used. A useful screen may be made by mounting the tinfoil which is packed around cut film on a large sheet of cardboard. Creases or wrinkles in the tinfoil will not matter and will actually increase the diffusion. A photoelectric cell exposure meter may be used to check the evenness of illumination and obtain exposure.

Illumination with artificial light will depend upon the type of lighting unit or units employed. A rectangular surface, say up to 12 x 18 inches, may be illuminated very satisfactorily by the use of a square illuminator containing twelve of the 30-watt automobile headlight size 105-115-volt lamps mentioned previously, mounted three on each arm. These are mounted in parabolic troughlike reflectors and the camera lens protrudes through the center of the square. By increasing the dimensions of the square and the number of the lights, larger areas may be covered. In some cases, the lights may be placed in a circular mount. Ordinary gooseneck desk lamps may also be used. Two or four of these will serve very well for documentary originals. At the present time there are many inexpensive aluminum reflectors on the market intended for use with photoflood lamps. Some are equipped with universal socket heads and rubber shielded clamps for mounting on any convenient shelf, table or other support. The clamps may be removed and regular laboratory stands substituted in order to gain increased flexibility. It is also possible to purchase sockets and reflectors of many types from electrical supply dealers. Long troughlike reflectors may sometimes be improvised from gutters and other standard builders' tinware. Any tinsmith with a bending machine can bend trough reflectors to order for a reasonable price. The metal should be velvet finish and not shiny in order to secure better diffusion.

Regardless of the exact nature of the lighting equipment used, it is good practice to illuminate an area considerably larger than that covered by the original. This will assure sufficient even light in the center of the field. A square or rectangular area may be illuminated by two lights placed along the sides and at an angle of about 45° to the original. The lights should be about one-half the diagonal of the area of the original from its edge. A better plan of illumination for a larger area would require the use of four lights, one placed in each corner of the square or rectangle and each distant one-half the diagonal from the corner. Gross objects will require illumination suited to their particular needs. This may be furnished by the two lights previously suggested or other means may be required.

Sensitive Materials

Photographic sensitive materials are composed of two principal parts, namely, an emulsion and a base. The emulsion contains the light sensitive silver halide or other light sensitive material, and the base is used to support this emulsion in the camera. A great variety of emulsions and three types of bases are used in documentary reproduction.

Photographic emulsions may be classified under four general headings:

1. Color-blind
2. Orthochromatic
3. Panchromatic
4. Special

Color-blind emulsions are sensitive only to blue and violet light. They are generally quite slow. Orthochromatic emulsions are faster, and in addition to being sensitive to blue and violet light, are also sensitive to green and yellow light. Panchromatic, or fully color sensitive emulsions, are sensitive to all colors, as the name would indicate. Special emulsions include full color sensitizations of various types, special infrared material and the like.

The bases are glass, cellulose acetate and cellulose nitrate film, and paper. The glass plate has long been a stand-by of professional photographers, but it is heavy, fragile and relatively costly. It was replaced by cellulose nitrate film, which provides an excellent support, but is highly combustible. In fact, old and deteriorated nitrate film in quantity is almost as dangerous as gun cotton. Principally through the requirements of the motion picture industry, a slow-burning acetate and finally a "safety" acetate base has been evolved. This is far more satisfactory than the nitrate in view of the possible hazard to human life. It is no more inflammable than ordinary paper. FOR ALL WORK WHERE FILM NEGATIVES ARE PRESERVED, CELLULOSE ACETATE OR SAFETY FILM SHOULD BE SPECIFIED. Both glass and film are transparent supports. Paper, the third support, is opaque. In conventional photographic practice it is usual to prepare the negative on a transparent base and print it on paper which carries a somewhat different sensitization

than the negative emulsion. As will be indicated later, it is quite possible, and in fact sometimes highly desirable, economically and otherwise, to utilize paper for making the original negative.

In physical format, glass plates are available in a great variety of cut sizes. It is not desirable, except in emergencies, to cut glass plates. Film and paper are furnished in rolls and in cut sheets. Either may be used. It is sometimes possible to effect a considerable saving through the purchase of large sheets or rolls of film or paper which can be cut to size in a darkroom. A trimming board is of great assistance in this work, and it is necessary to use the appropriate safelight. Manufacturers will cut rolls to any desired width if a quantity of sensitive material is purchased.

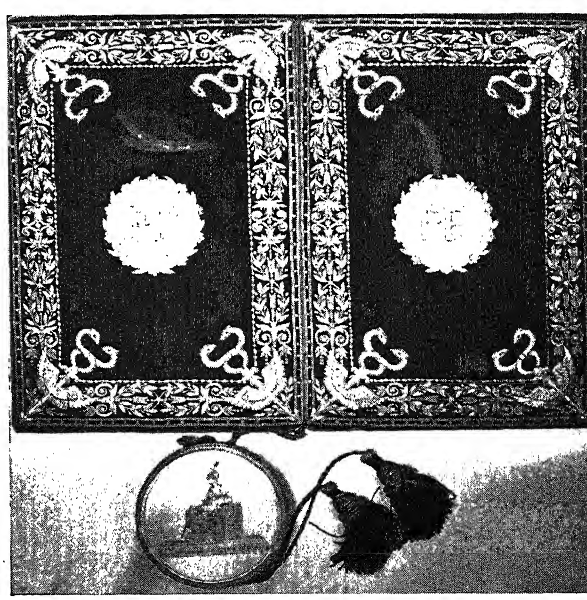
It is of utmost importance in documentary reproduction to match the film used to the particular original to be reproduced and the kind of copy desired. This is necessary not only to secure best results, but also to obtain them as cheaply as possible. It is not implied that each job will require a particular film, yet some jobs cannot be done satisfactorily without the precise characteristics of one material. In general, **full tone copies** will require a long scale medium contrast negative material. Orthochromatic materials, particularly those of moderate speed, are frequently used for originals in monochrome. If color correction problems are encountered a slow or medium speed fine grain panchromatic film is required. **Contrast copies** may be made of monochromatic originals on the slow process type emulsions. Commercial and process emulsions are widely used. The former yield slightly less contrasty results. For extreme contrast with film the materials used by the graphic arts such as Kodalith, Reprolith, Hammer Offset and similar films may be used. They yield maximum contrast but are very slow and require a great deal of light. When color problems are encountered, commercial ortho or commercial panchromatic, process ortho and process panchromatic or graphic arts ortho film may be used. **Corrected copies** require orthochromatic or panchromatic emulsions similar to those used for contrast copies with color problems. **Special copies** will require special films for the most part. Color reproductions may be made on Agfa color plates, Finlay process plates, Dufaycolor films and Kodachrome films. In addition, some of the color processes utilize regular panchromatic and orthochromatic materials. Special infra-red sensitive film and plates are available for infra-red work. Ultra violet work may require special materials, or if fluorescence photography is undertaken, process orthochromatic or panchromatic film may be used. Slower films are used in documentary reproduction as they give better rendition and increased contrast. Very fast films are intended for other purposes but may be employed in special cases with particular problems.

Color Filters and Their Use

Complete mastery of filters is the mark of the finished documentary reproduction technician, for color and other filters are among the most useful of his tools. The proper use of a colored slip of gelatin or a bit of glass in conjunction with the appropriate light, sensitive material and exposure may mean the difference between success and failure with a difficult original.

An understanding of the nature of color is vital in order to understand filters, yet even a brief outline of color and its physical, chemical and psychological background would occupy an entire volume. The serious student is referred to standard textbooks on the subject, and a beginning may be made with some of the excellent booklets published by the Eastman Kodak Company, among them, *The Photography of Colored Objects* (14th edition revised 1938, $1.00) *Wratten Light Filters* (13th edition revised 1934, $.50) *Photography by Polarized Light* (1938, $.50). The section on Color Photography in *Miniature Camera Work* published by Morgan & Lester (1938, $4.00) will be found useful.

In barest outline, white light may be divided into a number of so-called wave lengths which produce in the human eye the sensation of color. It is customary to group the almost infinite number of colors into three basic color bands: red, green and blue. Beyond the red, long wave lengths invisible to the human eye but not beyond the sensitivity of a photographic emulsion called infra-red rays are found. Below the blue-violet, short waves also invisible to the human eye but which may be recorded photographically exist. White light is composed of a correct combination of all colors, while black is generally accepted to be the absence of color, or its total absorption. The sensation of color may be considered as a phenomenon of absorption and reflection. A red object appears red because it **absorbs** green and blue and **reflects** red. An original with many colors, as for example a painting, is considered chromatic, while another with a long monochrome scale, as a conventional photograph, ranging from white to black, is achromatic.



5. LOUISIANA PURCHASE. French exchange copy in the National Archives.

It has already been noted that photographic emulsions are sensitive to various colors. Ordinary film is sensitive only to violet-blue, orthochromatic is sensitive to violet-blue and green, while panchromatic film is sensitive to violet-blue, green and red. By the proper use of filters a colored original may be photographed in monochrome in two ways, that is, with **compensating filters**, which will render the colors in the original in monochrome with more or less the same values or visual intensity as the original is seen by the human eye, or with **contrast filters**, which will emphasize or delete one or more colors provided that the appropriate sensitive material has been used. A filter will be effective only with emulsion sensitive to the color it transmits. A red filter with ordinary or orthochromatic film would be useless as these emulsions are not sensitive to red light.

To examine compensating and contrast filters more closely, examples may be helpful. If a painting of a red barn in a green field were to be reproduced in monochrome, the green field might appear darker than the red barn to the human eye, while photographically the two colors might be of almost equal intensity and would therefore appear as identical shades of gray in the reproduction. In order to retain the apparent visual values, panchromatic film and a light red filter would be selected. The red would reproduce light, while the green field would be darker in proportion to the strength of the filter. A contrast filter can either eliminate an unwanted color, as for example a red ink stain over a book page (panchromatic film is selected and a deep red filter slightly darker than the stain is used) or it may reinforce a weak color, which might be encountered in reproducing a page of manuscript. A faint greenish blue ink photographed with panchromatic film and a red filter will appear dark gray or black.

In general the lighter filters are used for correction or compensation while the deeper or stronger filters are used for contrast work. With contrast filters for deletions a filter the same color as that to be deleted but slightly darker in color is used. With contrast filters for emphasis the filter opposite in the color triangle, red, green and blue, is used. For example, red ink may be photographed through a blue filter, blue or green ink through a red filter, etc.

A further important fact about filters is the need for increasing the exposure when they are used. This is caused by the partial transmission of light of certain wave lengths which effectively serves to decrease the sensitivity of the emulsion, thereby necessitating an increase in exposure proportional to the lost sensitivity. This is known as the filter factor and a sheet containing the factors of each emulsion batch is usually included with each package of film or plates. There is not usually much change in the filter factors, yet emulsions are not constant in color sensitivity, hence it is wise to check the factor with each new batch of material.

Thus far only the more commonly used filters have been considered. There are several others which may be regarded as special purpose filters. Among these are polarization filters which are used to eliminate reflection by light polarization when photographing highly reflective objects, as framed pictures or documents, glass, paintings, coins, medals, etc. Infrared filters are also used extensively in documentary reproduction for deciphering charred or burned manuscripts, printed matter, and in addition for removing censors' ink over printing. Ultra violet filters may also be used in the deciphering of messages written in sympathetic ink, for bringing up obliterated passages and the like, yet their use is too involved for consideration at this time. Special color filters for color reproduction, both by color films such as Kodachrome or Dufaycolor or by two- and three-color processes, are also used.

Most filters are available in one or more of four formats: gelatin slips, mounted in "B" glass, mounted in "A" glass flats, and special colored glass optically worked. The latter two are most expensive. The gelatin filters may be mounted in temporary cardboard filter mounts or may be inserted between the lens elements. This latter procedure is not generally recommended. Unmounted gelatin filters are not permanent and must not be touched with fingers as they are almost impossible to clean, but serve very well for transient use. As they are cheap, it is a good plan to use them for experimental work. If they are frequently used, they may be mounted or purchased in "B" glass. "B" glass filters are mounted in good quality lens type optical glass and are quite satisfactory for general work. For color and other high precision reproduction the "A" or the solid glass filters may be required.

Mounted filters should be cared for precisely as though they were lenses. They are best stored in boxes with tight dust excluding covers, and should be kept clean with lens tissue. If badly soiled, Xylene, or an equivalent cleaner, should be used. Do not use water to clean filters. In using filters with the camera, care should be employed to place them squarely in the optical system.

Commencing to Work

With an original or originals to copy, a camera, stand, lights, and sensitive material, the operator is ready to commence actual work.

A few remarks about working space might be pertinent. If the copying equipment to be used is of moderate size and the originals are not too large, a sturdy table with plenty of room for laying out equipment and various accessories will be found useful. The writer prefers a location removed from windows and natural light. Any ceiling lights and general lighting fixtures are switched off.

There are a number of not essential but very convenient small articles which will assist materially in work of this nature. They may be listed as follows:

1. Focusing magnifier. The focusing magnifier should be at least 4 to 5 power. A "linen tester" which folds compactly into a leather case is very suitable. It has a small stand which maintains it in exact focus.

2. Scissors, sharp knife, paste, scotch tape, pencil, pen and ink, scratch paper.

3. Transparent ruler, graduated in centimeters on one edge and in inches on the other.

4. Supply of white matte paper (photographic blotters serve very well) and black paper (the black paper packed with photographic film or paper is ideal).

5. Old calendar (used to obtain supply of numbers for numbering exposures and for other purposes).

6. Clear plate glass. One or more pieces of quarter-inch selected quality plate glass are exceedingly useful for documentary materials. These are used to hold originals flat and should be several inches larger than the largest document commonly copied. The edges should be bound with scotch tape in order to avoid cutting the hands.

7. Photographic timer or watch with a second hand. A cheap electric clock with a long second hand is suitable.

8. Level. A small two-way photographic level is inexpensive and perfectly satisfactory.

With this miscellany available, the operator should classify the original in terms of one of the classifications previously mentioned. This will become an automatic procedure. The next step should be the determination of the appropriate film to be used in terms of the original and the kind of copy which will be needed. The third step will be the preparation of notes on the work in progress.

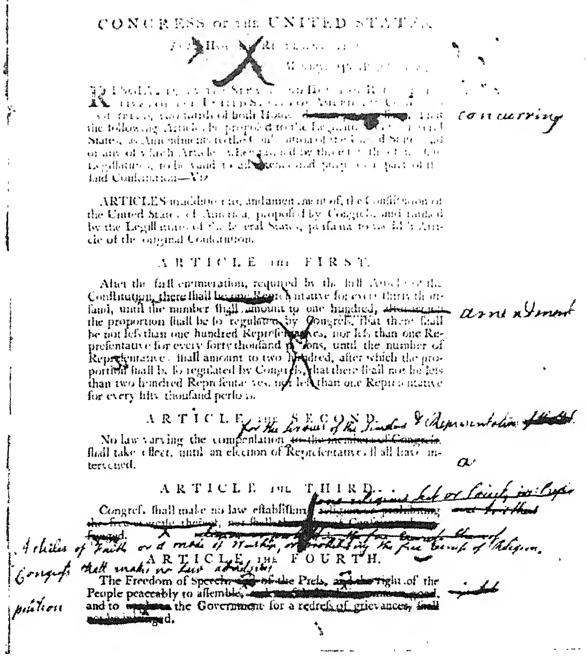
The accompanying notebook form has been worked out to facilitate record keeping. Every operator, whether amateur or professional, should keep an accurate record of his work. Although no two originals are ever exactly alike, reference to a notebook will answer many perplexing questions, and the small amount of time expended in filling out a form of this type will be well repaid later in savings of time and sensitive material. The record form, in this case an $8\frac{1}{2} \times 5\frac{1}{2}$ loose-leaf sheet, contains the following information:

TYPICAL NOTEBOOK FORM

DOCUMENTARY RECORD SHEET

Date....................
Subject ....
Original (class) ....
Bound or Unbound ....
Size of page ....
Number of pages ....
Kind of copy ....
Ratio of reduction ....
Placement ....
How copy is to be used ....
Camera used ....
Film (kind and make) ....
Emulsion number ....
Filter number ....
Diaphragm setting ....
Lights (kind) ....
Horizontal ....inches
Vertical ....inches
Voltage used ....volts
Reflection ....f.c.
Exposure time ....secs.
Developer number ....
Time developed ....

See other side for remarks and incidental notes.


CONGRESS OF THE UNITED STATES.

concurring

ARTICLE THE FIRST.

amendment

ARTICLE THE SECOND.

ARTICLE THE THIRD.

ARTICLE THE FOURTH.

The Freedom of Speech, and of the Press, and the right of the People peaceably to assemble, and to petition the Government for a redress of grievances, shall

6. FIRST TEN AMENDMENTS (*first page*) to the Constitution proposed by the House of Representatives. Photographed at the National Archives.

Subject. A full description of the original should be entered. If it is taken from a bound book or manuscript, the title and page numbers as well as the location of the original should be listed. A similar description for other originals should be given. It is always a good plan to include the reasons for making the copy.

Following the subject, a number of classifications and spaces for various data are provided. These have been grouped in order to supply complete reference notes which can be prepared in a minimum of time.

1. **Original.** The original should be classified in terms of the classification previously mentioned, and may be indicated by a figure, as for example, I is equivalent to manuscript, III to line originals, V to gross objects, VI to composites.

2. **Bound or unbound** refers to the condition of the original.

3. **Size of page.** It is very convenient to list the size of page in centimeters rather than in inches. Rough measurements of gross objects might also be entered. In writing the size of the page it is conventional to list the binding edge, if any, first. Thus, a sheet of ordinary letter size typewriter paper would be written $11 \times 8\frac{1}{2}$.

4. **Number of pages** refers, of course, to the number of pages copied.

5. **The kind of copy** relates to the classification previously given, as full tone, contrast, corrected, or color.

6. **The ratio of reduction** is the number of diameters **linear** which the original is reduced in order to place it on the film.[1]

[1] Linear ratio of reduction concerns measurements on the length and breadth of an original, while area reduction refers directly to the reduction in area. For example, a sheet of paper 8 x 12 inches in size reduced 8 times linear would measure 1 x $1\frac{1}{2}$ inches. If the same reduction were to be considered in terms of area reduction, it would be 96/1.5 or 64 times. It is therefore obvious that area reduction is equivalent to the square of linear reduction.

7. **Placement** is the orientation of the image on film. It is of primary importance in microphotography.

8. How the copy is to be used should be entered, whether as prints, transparencies, lantern slides, etc.

9. **Camera used.**

10. **Film.** Kind, make, emulsion number. This is highly important if a number of copies are being made, as it enables a check on possible defective material with the manufacturer.

11. **Filter number,** if filter is used.

12. **Diaphragm** setting or aperture.

13. **Lights.** Kind should be listed, together with the horizontal and vertical distances in inches or centimeters above the original.

14. **Voltage used,** as measured by an input voltage meter.

15. **Reflection.** This refers to the amount of light reflected from the original in arbitrarily designated foot-candles, as discussed under **Light Control.**

16. **Exposure** time in seconds or fraction.

17. **Developer** number.

18. **Time developed.**

All of this material can be incorporated on one side of an 8½ x 5½ sheet, leaving the reverse blank for further notes. When single originals are being copied, a contact print or a reduced size print is sometimes mounted on the reverse of this form in order to facilitate reference. Needless to say, the notebook form cannot be filled out completely at one time, but the notebook should be opened and the various entries made as the work progresses.

Thus far most of the work, except of course the assembly of the equipment in one place, has been mental. At this point it is necessary to place the original on the copyholder and prepare to make the actual exposure.

Holding the Original in Place

Originals of Classes I, II, III, IV, and sometimes VI are usually in bound or unbound form on paper or some similar substance. If the material is unbound, reproduction is much easier, for it may be placed flat on a horizontal copyholder or vertically as the equipment may require. Bound materials, on the other hand, are far more difficult to copy, particularly in quantity. For those who may be copying an entire volume, as is frequently done in microphotography, a bookholder is available from the Folmer Graflex Corporation. It consists of a pair of platens mounted in a box with a glass cover. The platens equalize the two sides of the book in so far as possible and present a plane surface for copying. Books up to 19½ x 26 inches in spread may be accommodated. A flat board which fits above the platens holds unbound material in position.

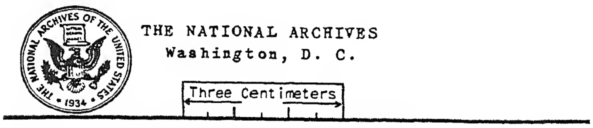
A bookholder is extremely convenient, and if any amount of copying is done will pay for itself in a short time. On the other hand, it is not absolutely necessary, as many other methods of holding the original may be devised. One of the simplest of these consists merely in blocking up the book by means of wooden blocks and in some cases pieces of cardboard,—a glass plate, if necessary, are then placed over the book, and the reproduction is made. There have been many variations of this simple device, including the use of long tapered wooden wedges. In some cases when no glass is used the operator will be tempted to place his fingers on the edge of the book to hold it open. This will mar an otherwise suitable negative, and the presence of the hand near the page surface will sometimes reflect considerable light on the original being copied, and introduce further deformities into the reproduction. If no glass is handy and a page must be kept down, a paper clip, which has been bent out straight, a thin bit of wire, or in emergencies even a pencil can be used.

Documentary originals may or may not require backing with white, black or sometimes tinted paper. If the original paper is very thin and written on both sides, the writing on the reverse of the page will frequently show through. In some cases it is almost impossible to alleviate this condition. In others, it is very simply handled by backing the sheet to be copied with dead black paper. When careful facsimiles are being made, it is frequently advisable to back the original with black or tinted paper in order that the margins of the document may be accurately determined. When writing is very faint, a white sheet of paper may be used for background.

Gross objects in documentary reproduction are susceptible to no general rule. In a sense this is practically equivalent to small object photography. The problems of lighting are many and are varied in each instance. A few general remarks may be of interest. Shadowless outlines of small objects may be secured by elevating the original several inches above a black plush or velvet background on a piece of glass. Specifically, the illustration here included was held approximately six inches above a piece of velvet on a piece of glass 8 x 10 inches in size (which incidentally was an old glass plate which had been cleaned). The supporting medium was a pile of books on each side. Two lights were used, 14 inches above the subject. Many objects may be copied using white, black, or neutral gray backgrounds.

Assuming that the original is held in position on the copy board, with its plane surface perfectly parallel to that of the film, it is next necessary to provide some **method of identification.** For conventional documentary materials this may include the name of the maker or the institution, a description of the original, and a centimeter scale. The appended illustration is the form used in The National Archives for this purpose. Identifying data are typed or written in ink in the space provided, and in some cases exposure numbers are included. These numbers are entered on the notebook record sheet. Whenever possible a scale should be photographed on the negative with the original. A transparent rule is excellent for this purpose, although in some instances

it may require backing with white paper. This renders reproduction to size by projection printing exceedingly easy and convenient. It also assists visualization of the object. By reason of its easy arithmetical handling the writer prefers the metric system for scales. When a number of similar originals are being copied, the scale may be affixed to the copyholder in a convenient position with scotch tape. This will save time and labor.



7. Typical scale and identification paper used in copy material at the National Archives.

In copying manuscripts which do not have page numbers in the original, page numbers should be provided. As these cannot be written in most cases on the manuscript itself, they may be written or printed on bits of paper and laid on the original or on the covering glass plate if one is used. As mentioned previously, an old calendar provides an excellent source of numbers. In some cases difficulty may be encountered with the old folio system of numbering. A folio as generally known in this country consists of a sheet of paper. This may carry writing on front and back, and thus in reality represents two pages. Each folio may be numbered. In conventional breakdown of this system, the front sheet, or the one on which the number generally appears, is the recto, while the back of the sheet is known as the verso. Abbreviations of r. and v. respectively can therefore be added to the numbers. If only a portion of a page is reproduced, it is usually customary to count the lines and the words beginning from left to right. A possible citation would be "folio 126v. L, 5-9." This would mean the verso side of folio 126, lines 5 to 9 inclusive. It would be equivalent, other things being equal, to copying lines 5 to 9 on page 252 of a conventionally numbered book.

Focusing

The next step to be considered is focusing. It is important and should be conducted with the greatest of care, as the quality of the reproduction is largely dependent on proper focusing. Four methods of focusing are in common use:

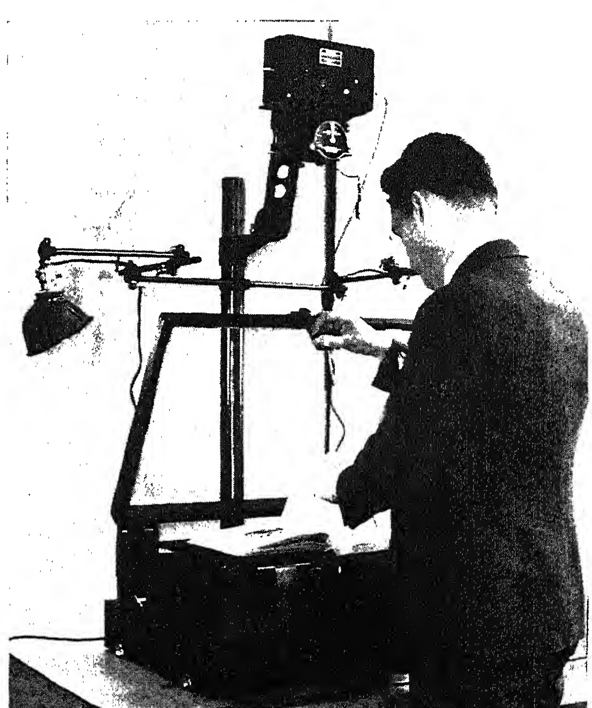
1. Measurement
2. Visual
3. Micrometer by test strip
4. Projection

1. **In focusing by measurement** the camera is usually calibrated to the stand, and focusing is achieved by measurement and calibration. This system has been employed with considerable success with miniature cameras, and if the operator understands his equipment, its limitations, and its peculiarities, there is no reason why successful focus by measurement cannot be obtained.

2. **Visual focusing** is easier. The image on the ground glass of the copying mechanism is observed and the camera is brought into perfect focus by means of the various adjustments. The lens should be opened to full aperture while this is being done, and a magnifying glass used in all cases. A clear spot in the center of the focusing screen is of material assistance, while a fine-grain focusing screen is also very desirable.

3. **Micrometer and test strip focusing** is usually employed with the largest high speed documentary copying cameras. The camera is focused as perfectly as possible by the visual method, using the ground glass and magnifier. A calibrated vernier focusing adjustment is then set at certain intervals and the readings are noted. These intervals are frequently as small as one millimeter. A series of exposures, sometimes as many as eight or ten, are made on each side of the best visual focus, and the film is developed. The developed film is then examined under a medium powered microscope, and the camera is set with the vernier to the sharpest of the test images. Obviously, this system of focusing is expensive and time consuming. It is practical only with large capacity microfilming cameras engaged in quantity production.

4. **The last method of focusing, that by projection,** is most ingenious. A geometrical pattern is projected on the surface of the original to be copied. This is achieved by constructing a simple lamp house and mounting it with the geometric design on a glass plate which is exactly in the film



8. Operating the Graflex Photorecord with the book cradle in position which affords quick handling of bound volumes.

plane of the camera being used. When the geometric design is perfectly sharp on the original, the camera is in focus. A small accessory known as the "See Sharp" focusing magnifier, which is widely used in projection printing, is useful.

Exposure

The amount of light allowed to pass through the lens and fall on the sensitive material is known as the exposure. Correct exposure, which is usually measured in seconds or fractions of a second, is essential. Many factors must be considered in computing an exposure, among them the nature and amount of light, the kind of copy desired, and the presence or absence of filters, the sensitive material and finally the aperture or diaphragm setting. All of these factors with the exception of the last have already been mentioned, but in order to understand exposure, the diaphragm and its adjustments must be fully understood.

The most common diaphragm now in general use is the iris, which is made up of flat metal or composition plates which open and close as an outer ring is turned forward or backward thereby passing more or less light through the lens. Lenses are said to possess a certain maximum speed which is merely the ratio of the focal length of the lens divided by the largest practicable working aperture of the diaphragm expressed as an f/ number. The iris ring is marked with numerical designations expressing ratios of size of aperture, as, for example, one lens for the Graphic contains the following markings: f/3.5, 4, 5.6, 8, 11, 16, 22, 32. This marking is very convenient, as each stop after f/3.5 in the series requires approximately twice the exposure for the stop immediately preceding or half that of the stop immediately following. It should be noted also that exposure varies as the square of the f-number, that is, an exposure which would be correct at f/4 would need to be quadrupled for stop f/8, or multiplied 16 times if f/16 were to be used.

Focusing is usually carried out at maximum aperture, but actual work requires a smaller aperture in order to obtain maximum definition and depth of focus. Each worker will discover the best working stops for his individual equipment, but in general most copies may be made at f/11, 16 or 22 with shorter focus lenses, while longer focus lenses sometimes require f/32 or even f/64. Once the correct exposure at one stop setting has been worked out, it is a simple matter to compute the correct exposure for a smaller or larger stop.

The determination of a basic exposure is not difficult. Three methods are common. The experienced photographer will compute his exposure on the basis of experience with similar originals, lighting conditions and film, and will probably verify his findings by a reference to his notebook. With a new original, film or set of conditions the correct exposure may sometimes be measured with a photoelectric exposure meter. This is set for the speed of the film and is used in the conventional manner. Some operators take a reading at a fixed distance above the original, while others take the reading at the camera lens. It is frequently convenient to take four readings on sectors of the original and average the findings. If the original is small it is sometimes advisable to take a reading on a larger sheet of neutral gray paper. The last method is by test exposure, or by test strip. This merely means the making of a series of exposures **doubling the time for each**, and from the developed film or plate computing the correct exposure for the given original and type of copy desired. This system is costly for plate and sheet film cameras, but the cost may be cut by covering most of the original with a sheet of black paper and making successive exposures on the same film withdrawing the sheet a few inches more for each exposure. The same result may be achieved by removing the slide of the plate or film holder partially for each of a series of exposures and measuring the sums of the exposures on the developed material.

In general longer rather than shorter exposures are to be preferred in documentary reproduction if the bulb setting is used and the exposure is given by hand. The reason for this is the difficulty of counting or giving a short exposure which will be uniform with a number of copies. If a series of exposures at a setting requiring one second are ¼ second over in timing, the exposure is ¼ wrong, while if the same error of ¼ second were encountered with an exposure of 8 seconds the difference is so slight that it may be disregarded. Absolute rigidity is necessary with longer exposures, and a cable release should always be used.

Light Control and Exposure

Three major variables may be altered to control exposure in documentary reproduction. They are aperture, time, and illumination. If a given original is to be recorded, a carefully calculated exposure or a test strip will facilitate the making of an image of the desired quality. The data are usually expressed in terms of an exposure of so many seconds at a particular diaphragm aperture, using certain lights, sometimes giving the measurement or light placement, the type of film, and development. An exposure time is constant only for materials falling within the general classification of that which has been experimentally or otherwise determined.

Specifically, a two-page spread of printed material, measuring 9 x 12 inches, may be exposed for one-quarter of a second at f/16 on the Photorecord camera, using two photoflood lights 18 inches above the subject and 32 inches apart with an input of 115 volts, using Eastman ordinary positive 35mm film. This value will be

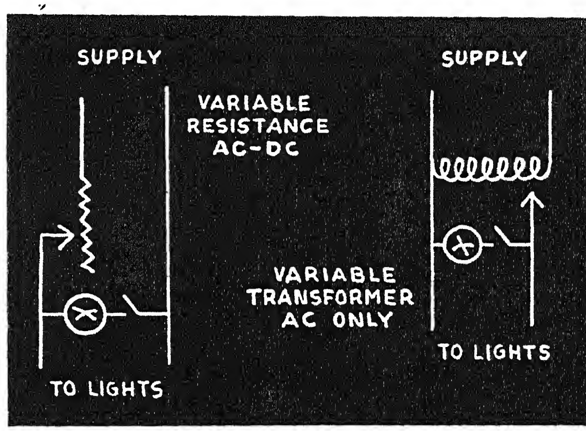
found more or less constant for similar originals of this size and condition. If, however, an original with black printing on yellowed paper is to be copied, some alteration in time, aperture, or illumination may be necessary.

In many cases it is inadvisable to alter the aperture greatly, as this may affect sharpness and legibility. It is often equally difficult to change the time employed, as this generally involves a change in camera setting, which in itself is not desirable. The illumination may be adjusted in two ways, namely, by changing the position of the lights in relation to the copy, or by altering the intensity of the lights themselves. The first method is cumbersome in that the law of inverse squares must be considered. That is, the illumination varies inversely as the squares of the distances from a point source of light. In other words an original illuminated by a light 24 inches away would receive one-fourth the amount of light from the same source if it were moved to 48 inches distance ($24^2/48^2=\frac{1}{4}$). The second method is not difficult as a suitable rheostat or transformer will provide a smooth and even voltage change. If direct current is being used, a variable resistance is necessary. The theory of light control is based on the property of a tungsten lamp to produce light in proportion to the voltage employed.[1] Photoflood lamps are so constructed that an excess of voltage is used in order to secure a higher actinic light emission at a **sacrifice in the life or burning time of the bulb.**

Assuming, therefore, that a variable transformer or resistance has been procured and placed in the lighting circuit according to the appended wiring diagrams (Fig. 9), using the same camera, the same type of film, and identical light placement and original, a set of experiments may be undertaken. It is obvious that a standard or basic exposure, which will allow variation either upward or downward, should be adopted, and it may be obtained by calculation or test strip. With the original in question and suitable adjustments on the camera, a series of exposures are made. Assuming that the aperture is set at f/11 and the time remains constant at one-half second, exposures are made of the standard black on white printed original at from 60 to 110 volts by ten-volt steps. The results show that at 60 volts the image produced is so light as to be almost imperceptible. At 70 volts the density of the image is somewhat increased but is still very light. At 80 volts a further darkening is apparent, and the negative reproduction would be usable in a reading machine. At 90 volts a good general purpose negative suitable either for printing or reading machine use would be secured. At 100 volts the image would be well suited for the making of paper or film prints, and while somewhat dark can still be read on a reading machine. At 110 volts the image is darker and the white portions of the negative, although still readable, are not transparent, but are slightly veiled. It is therefore demonstrated that printing copies of originals of this type may be reproduced satisfactorily with a voltage input of 90-100 volts.

[1] The spectral characteristics of tungsten lamps vary in proportion to the input voltages. At lower voltages a larger proportion of red and yellow light is emitted, while at higher voltages an increasing output of blue-violet is produced. As the latter is more actinic for most photographic purposes, particularly with non-panchromatized emulsions, this factor must be included in all computations.

At this point it is desirable to introduce and integrate the photoelectric cell light meter, which is of great utility in light control. The photoelectric light meter is an instrument which measures the amount of light reflected from an original. With tungsten electric light as a source, the amount of light reflected is directly proportional to the voltage input to the lighting system, as regulated by the variable resistance or the transformer. The photoelectric cell consists of a suitably mounted substance which has the property of transforming light into minute quantities of electricity, which may be measured on a sensitive dial-recording meter. Photoelectric cell meters of this type are common in ordinary photography for determining exposure, and are also used for other purposes. In the experiments being described, an illumination meter as employed by lighting engineers was used.



9. Rheostat and transformer for light control as described on this page.

Uniting these factors and applying them to microphotographic problems, let us assume that the basic exposure to secure a desirable printing negative of black printing on white paper is 80 volts, and that the reflection is 40 foot-candles. By substituting a sheet of paper in which the background material is colored, perhaps yellowed by age, under the photoelectric meter, a reflection of only 30 foot-candles would result, and the basic exposure would produce a negative of less than printing density as determined by the series of voltage input experiments previously undertaken. On the other hand, if the rheostat is advanced sufficiently the meter will read a reflection of 40 foot-candles, and a negative of approximately the same density as that produced by photographing the black on white original will result. The voltage, however, has been increased. In this factor lies the entire principle of light control, which may be simply stated as follows: Set the camera and measure the light reflection necessary to produce a negative of

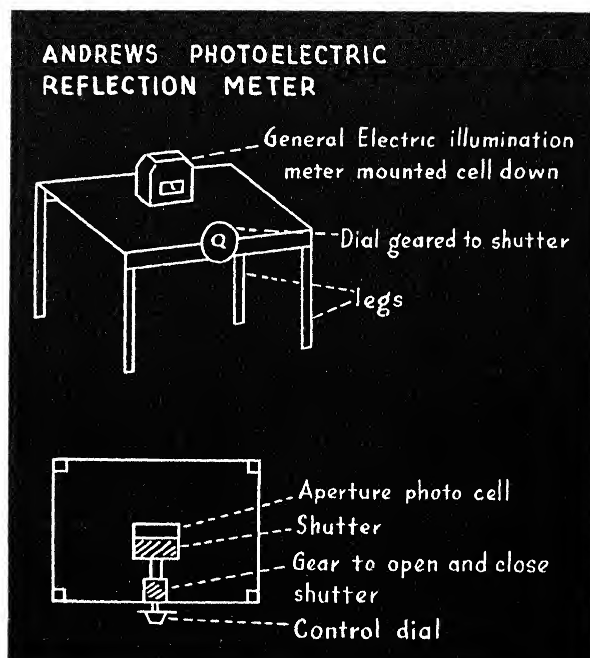
the desired density with a black on white original. Adjust the voltage for faded writing, printing, or stained discolored backgrounds, so that the reflection figure is the same as that produced for the black on white original. Photograph this original using the same aperture and time, and the result will approximate a negative of the desired quality.

The foregoing outline of light control will facilitate its use with most ordinary problems, but there are several additional considerations which must be well understood, as indiscriminate application may result in failure. The principle by which written information is rendered useful is that of contrast. A medium which is more or less sharply distinguishable from a background is employed, as, for example, in black writing on white paper. There are two types of contrast and background media which may be called the achromatic and the chromatic series. **The achromatic series** may be considered as varying shades of black on a white background, or the exact reverse, white on varying shades of black background. A white contrast medium on a white sheet of paper is indistinguishable, hence useless to convey information. Similarly, black ink on a black background is equally useless, as there is no distinction between the contrast medium and the background. Between these two extremes lie many variations. It should be stressed that in most cases photography may not be able to increase materially the distinction between contrast medium and background in the achromatic series.

The chromatic series, which simply means color as we understand it, is susceptible of far greater treatment. It is possible to make an almost infinite variety of combinations of background and contrast medium, using both the chromatic and the achromatic series. We use paper of varying colors and write upon it in ink or pencil of many different colors, attempting, usually, to preserve as high a contrast as possible when the product is viewed by the human eye. It has been discovered, for example, that black on yellow is more legible for highway signs than black on white. Similarly, individuals prefer to use green, blue, purple, or sometimes red ink on whatever paper is at hand. In some cases certain colors of inks have acquired particular significance through use and tradition. For example, in bookkeeping red ink has become synonymous with loss.

A specially built unit may have certain advantages, notably in allowing the sensitive unit or photoelectric cell to be permanently mounted on the camera or camera stand, while the reading meter is incorporated in the base of the copying machine. One of the standard meters in conjunction with certain other apparatus is a very efficient and useful reflection measuring device. Figure 10 illustrates an instrument devised by Mr. Charles Andrews of the Eastman Kodak Company. A General Electric illumination meter was mounted on a metal bed photocell down, and a slot the size of the photoelectric cell was cut through the base. A sliding shutter to close this opening, operated by helical gears from a control dial, was mounted on the underside of the metal base. The principal advantages of this system are, first, the possibility of calibrating the control dial for films of varying sensitivity, and second, the possibility of extending the range of the meter by halving or quartering the exposed surface, thereby allowing reflection intensities beyond the unmodified scale to be measured. The light meter is mounted on four small metal rods in the form of a quadrupod which holds the photocell a fixed distance above the original being measured, thereby insuring constant values of the readings. If it is undesirable to build a complete stand, a set of carefully made masks will extend the range of the reading dial of the instrument, and in addition will allow compensation for various kinds of negative material.

A typical example of the use of light control was involved in a problem encountered at The National Archives. Approximately 16,000 3 x 5 index cards were to be photographed. The majority were printed or written in black on white background. The balance were printed or written on dark brown manila card stock. The two types of cards were indiscriminately mixed in the file. A complicating factor was the necessity for filtering. Even utilizing light control, the normal distinction between background and contrast medium was not sufficient to produce a suitable image of the black writing on the manila card, hence a color filter was necessary to increase the contrast between background and text. In this case, a positive film with a certain amount of red sensitivity which rendered it susceptible to filtering with a moderate yellow filter was employed. Through the use of a Wratten K-2 filter, a negative could be procured from the manila card which compared favorably with the black on white original. The voltage would of necessity need to be increased proportional to the factor of the filter being used. A further characteristic of filters was utilized, notably that they are active only when originals possessing characteristics which render



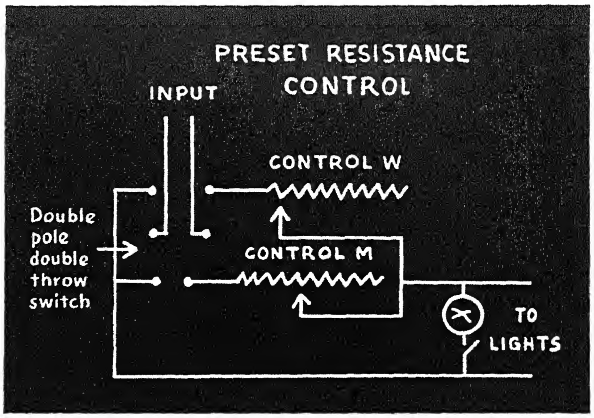
10. Andrews Photo Electric Cell Reflection Meter, fully described on this page.

them susceptible to filtering are present; that is, that the only effect a K-2 filter would have in producing a negative of a black on white subject would be a prolongation of the exposure, while, on the other hand, a black on manila card, which could be filtered, would be acted upon. Through measurement with the light meter, it was discovered that with the Photorecord camera 15¼ inches above the subject, two photoflood bulbs placed 12 inches above the original and 21 inches apart (on centers) would reproduce the card file at a low reduction of approximately 5 diameters. The entire catalog of sixteen thousand cards was, therefore, reproduced through a yellow filter at the above setting, but the voltage was altered to correspond to the nature of the cards themselves; that is, the white cards were photographed at 101 volts, while the brown cards received 115 volts. Direct current was used throughout.

It was necessary, in order to save time, to devise an apparatus for altering voltages rapidly. Two Elkay photoflood controls were used in conjunction with a double-pole, double-throw switch mounted vertically. The wiring diagram for this arrangement is appended (Fig. 11). One of the photoflood controls was set to admit 101 volts to the camera, and was designated as Control W (to be used with white cards); the second photoflood control was set to deliver 115 volts to the light system, and was designated as Control M (to be used with manila cards). These designations were placed on the double-pole, double-throw switch for the convenience of the operator. As the cards were hand-fed, this system worked as follows: The operator selected the cards to be photographed in sequence from the card tray. When white cards were being photographed, the double-pole, double-throw switch was placed in the W position and 101 volts were admitted to the lights. When a manila card was encountered in the file, the switch was moved over to the M position and 115 volts were admitted to the lights. This action was accomplished by the operator without a noticeable loss of time in the operation, and a satisfactory negative was reproduced. Figure 12 shows the system in operation.

Processing

It is presumed that anyone undertaking copying will be familiar with the routine methods of processing ordinary film. In general, the techniques used in processing documentary reproduction negatives are not essentially different from those employed in ordinary photography.

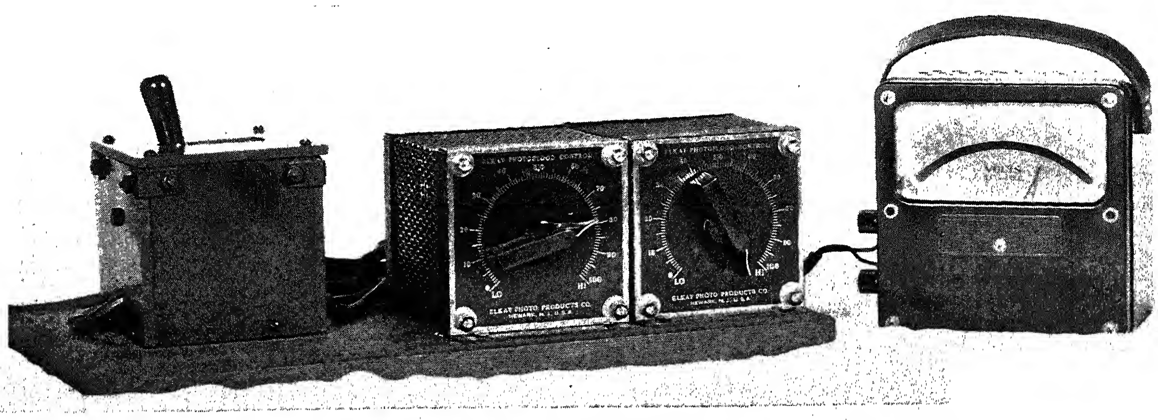


11. Pre-set Resistance Control showing the wiring diagram. Figure 12 shows actual photograph of this equipment.

Great care must be exercised throughout all of the operations in order to produce acceptable copies. Tray or tank development, depending on available facilities and amount of work, are usually employed for cut films, plates, and paper. Long lengths of narrow film may require a specialized procedure, which will be taken up in another connection. Accurate time and temperature control is essential.

If the negatives which are made are archival in character, or if they are to be permanent as possible, the following procedure is suggested:

1. Develop
2. Stop development in stop bath
3. Fix in hypo bath with hardener
4. Wash 15 minutes in running water
5. Refix 15 minutes in fresh hypo bath with or without hardener as desired
6. Wash in running water 30 to 45 minutes
7. Test for residual hypo content
8. Dry under controlled conditions



12. This equipment assembled at the National Archives is used for Dual Pre-Set Resistance Control. A complete description is given in the text above.

The developer used will depend on the original, the film employed, and the kind of copy desired. The beginner is advised to follow the directions given by the manufacturer for processing the particular film being used. As he becomes familiar with a given sensitive material, he may introduce certain variations which are adapted to his use. The stop bath which is recommended between the developer and the fixing bath is of the acetic type. In some cases chrome alum hardener may be incorporated in this bath. The first fixing bath is usually the familiar Eastman Kodak Company's F-5 fixing bath with hardener. The negative is then washed. If the negatives are intended only for transitory use and not for permanent storage, after the washing they are dried. If, on the other hand, they are archival in type, a second fixing bath is frequently used. The benefits of this second fixing bath are debatable, but the general consensus of opinion seems to favor its use as a security measure. This solution should be fresh, and may or may not be compounded with hardener. The writer usually prefers the second solution without hardener. All solutions should be carefully compounded by weight, and should be thrown away when the exhaustion point is approached. New chemicals are cheaper than the cost of sensitive material and the labor expended in exposing it. The final wash bath before drying should be pure running water, and the negatives must be thoroughly washed. After washing has proceeded for 30 minutes, the negatives may be tested in one of the well-known testing solutions for residual hypo content. There are several tests in common use. The permanganate test which has been long considered adequate has fallen somewhat in disfavor, and is being replaced by the Crabtree-Ross test developed by the Eastman Kodak Company.

Final Steps

After a negative has been produced, the succeeding processes prepare it for use. For some documentary reproductions, notably in microphotography, the negative itself may be read. Other avenues of utilization include the making of film transparencies, lantern slides, and paper prints. The latter is by far the most common method of treatment.

The method of making a print of documentary material, the kind of paper used, and the method of finishing will depend entirely on the use to which the print is put. Frequently single weight glossy prints are preferred, particularly if they are to be used for reproduction. If large quantities of prints are being made, there are several fairly inexpensive papers which may be used. Insurance bromide paper, available in three weights from the Eastman Kodak Company, is an exceedingly fast, high contrast, matte surface enlarging paper. It is, moreover, very cheap. Great care must be used with this material, however, and it must be processed in red light. A newer paper, available in four degrees of contrast from the Photostat Corporation, formerly known as "Kind 869," is now marked as "Grade L." Contrasts increase from No. 1 which is soft to 4 which is extra hard. Contrast 3 is a good general purpose paper. This is a medium speed bromide paper, suitable either for high contrast work or for the reproduction of long scale negatives. It is also inexpensive. The Agfa Ansco Corporation markets many weights and surfaces of Brovira projection paper which is suitable for general work. Similarly, the Haloid Corporation has a number of documentary reproduction papers, among them "Record." Photostat or photocopying paper itself may be purchased in rolls or in some cases in cut sheets. Contact papers are available in all sizes, surfaces and thicknesses.

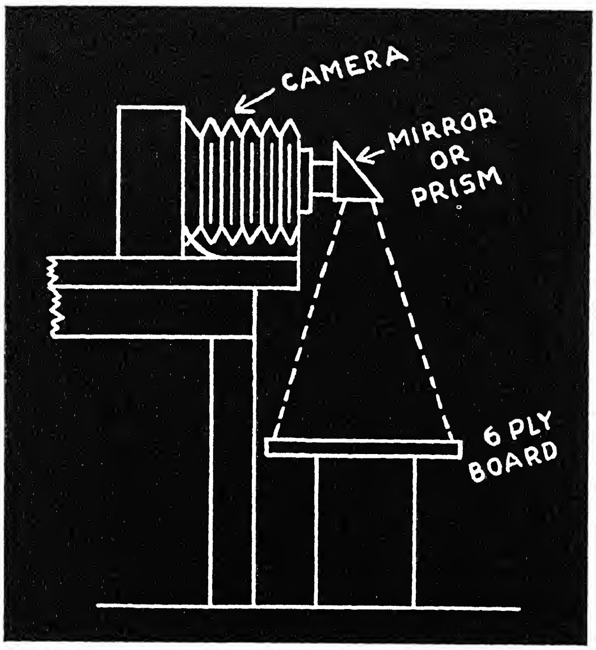
It is sometimes necessary to prepare a facsimile copy of an original for display purposes. This is frequently the case when valuable original documents cannot be loaned or removed from a depository. If the photographic facsimiles are carefully made, they are to the untrained eye practically indistinguishable from the originals. An attempt should be made to secure the maximum approximation of the original in a reproduction of this type, and frequently a full tone rather than a contrast copy is made. Color prints, of course, can be prepared by any of the well-known paper processes, but require highly specialized equipment and knowledge. This may not always be available to the amateur or professional not undertaking a great deal of this kind of work. It is, therefore, quite legitimate to prepare a paper facsimile, tone it, and color the print with a water color, oil, or colored inks. The transparent colors employed for tinting photographs may be used in some instances, but are not always uniformly satisfactory.

The procedure is roughly as follows: Secure a negative with the properties outlined previously. Select a paper with a surface as nearly approximating that of the original as possible. Prepare the print in the conventional manner by contact or projection to the exact size of the original document. If the original has been discolored by the passage of time or some other cause, tone the print in one of the standard toning formulas until the basic color of the major portion of the document is approximated. Finish and dry the print and then color the portions which are colored in the original, carefully matching the color. Trim the print with a sharp knife to the exact dimensions of the original, preserving any irregularities in the outline. Holes and tears can be cut out and frayed to resemble the original by using the back of a knife blade. The print is then dry mounted on mounting board and is ready for display. Single weight paper, matte surface, is customarily used for work of this type. Hand coloring has been used with considerable success for maps and similar originals where color is applied in heavy masses. It is not recommended for originals with a long chromatic scale, as, for example, portraits.

Paper in Documentary Reproduction

For many originals, particularly Classes I, II, III and sometimes VI (see page 127) it is possible to use paper as the original negative material, and also as the final

product. In fact there are specialized cameras made for this purpose which are widely used in business and academic centers under the name of photocopying or photostat machines. The simplest of these cameras do not differ except in a few minor particulars from an ordinary camera for documentary reproduction. The points of difference are in size, adjustment and feed of sensitive material. The professional machines are of varying sizes (usually denoted by the width of the roll of paper which they accept) from 11 to 18 inches; the largest machine accepts a sheet of paper 18 x 24 inches in size and is automatic so that the operator need only make the exposure, advance and cut off the exposed sheet, while the processing, washing and drying are all automatically carried out.



13. Drawing to show actual setup for making direct paper copies with an ordinary camera and the use of a right angle prism.

If a roll or a cut sheet of suitable sensitive paper is placed in an ordinary camera and a reproduction is made precisely as though film were being used, the result will be a negative image on paper with white lines on a black background. The image is "mirror reading," that is, it is reversed and the writing can be only read by holding the negative before a mirror. The large commercial machines reverse the image before it reaches the sensitive paper usually by means of a prism, so their product is a reversed direct reading negative. In these machines a positive is made by placing the reversed negative on the copy board and rephotographing it with the prism still in place in order to secure a direct reading positive or black on white image. It is possible, in fact easy, to equip an ordinary camera for documentary reproduction with a prism and thereby obtain direct reading positives. The prism is somewhat expensive, hence a mirror is generally used for this purpose. A first surface of plane (silvered on the face and not on the back) mirror is best although an ordinary mirror may be used. The camera is usually placed on the edge of a table and the mirror is attached so that the path of light entering the camera forms an angle of exactly 90°, and the copy is placed below. Inaccuracies in mirror placement may be detected in the ground glass which also serves for focusing. Roll film attachments for plate cameras may be loaded with paper and a series of exposures made with considerable rapidity. With an ordinary book or manuscript a very moderate reduction may be attained using paper 4 x 5 inches in size and the reduced paper copies may be read without difficulty. When roll paper is used, it is convenient to secure black paper of the same width and attach a leader and trailer strip to the sensitive material which will allow the camera to be loaded and unloaded in daylight. Dr. Dallas D. Irvine of The National Archives has used a National Graflex camera fitted as described above for making reduced facsimiles of documentary material.

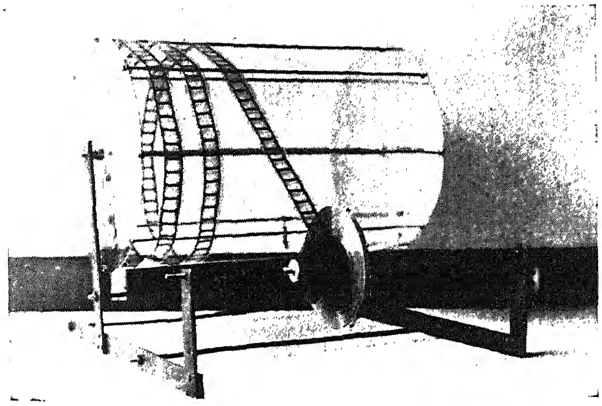
For work of this type a contrasty fast bromide paper is best. Photostat or photocopying paper may be purchased from most dealers. This paper is orthochromatic, and may be filtered. Panchromatic paper is also available. The paper is processed in trays using a contrast formula furnished with the paper by the manufacturer.

Microphotography with the Photorecord

In recent years 16 and 35mm safety film in long lengths has been employed extensively in documentary reproduction. Business houses, banks, insurance companies, title companies, manufacturing plants, the government, libraries, universities and individuals have copied thousands and even millions of pages of manuscripts, books and similar originals on these films. This process has become known as microphotography.

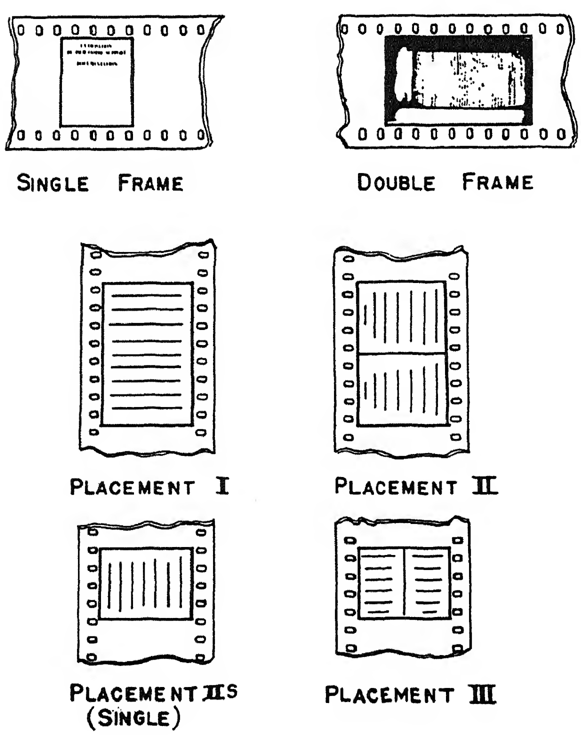
A microphotograph, microfilm, or microcopy is simply a reduced size facsimile of a documentary original on film, paper, glass, or other support. The technique of producing microfilms is essentially similar to that used for other techniques of documentary reproduction. An original is illuminated, and exposures on a suitable film are made in a specialized camera. The results are processed and used for reading by projection or for the making of paper prints.

One of the most popular self-contained microfilming cameras is the Folmer Graflex Photorecord. This machine is entirely self-contained in a carrying case weighing about 50 pounds. One side of the carrying case forms the base, and into this is fixed a circular upright column.



14. Drying Reel for exposed film, constructed by Dr. Atherton Seidell.

For easy packing, the column has been divided into sections which screw together for assembly. A camera supporting arm holds a specially designed camera head above the copyholder. The Photorecord will accept either $2\frac{1}{4}$ x $3\frac{1}{4}$ sheet film or plates in holders, or will accommodate one hundred feet of 35mm double perforated film in a special film magazine. An ingenious focusing device makes use of a lamphouse which projects a rectangle of light and which indicates what area the lens will cover at that camera setting. By bringing into sharp definition two lines scribed on the ground glass, critical focus is easily obtained.



15. The various placement positions of documents to be copied.

Illumination is provided by four reflectorized mushroom lamps. The mountings for these lamps are universal, and they may be placed in practically any position. These lamps have a life of approximately 1000 hours and are commercially known as R-40's.

The camera is operated by compressed air. A foot-operated bellows charges an airline. The film is moved forward in the camera, then after the film has stopped a by-pass valve operates the pneumatic shutter. Thus the entire cycle is governed by one motion, and the operator has both hands free for handling copy.

Only acetate base safety film should be used in microphotography. Two frame sizes are possible; one the motion picture single frame, which is approximately 1 inch by $\frac{3}{4}$ inch (24 x 18mm) long, and the other the so-called double frame, which is 1 inch wide by $1\frac{1}{2}$ inches (24 x 36mm) long. On these film areas documents are placed in four positions at varying ratios of minification. The positions, or placements, have been standardized by general usage as follows:

Placement I. One page to the double frame, with the reading line parallel to the short axis or width of the film.

Placement II. Two pages to the double frame, with the reading line parallel to the long axis or length of the film.

Placement II-S. One page to the single frame, with the reading line parallel to the long axis or length of the film.

Placement III. Two pages to the single frame, with the reading line parallel to the short axis or width of the film.

The placement which is selected must be fitted for the use which is to be made of the completed film.

The long lengths of narrow film encountered in microphotography are sometimes difficult to process. Several methods including rack and tank, reel and tank and continuous machine are in common use. The Folmer Graflex Corporation distributes one of the most popular, the Stineman system, which consists of a helical metal reel and three nesting tanks. Exposed film is wound on the reel in the darkroom and submerged in shallow circular tanks containing solutions. Rigid time and temperature control are necessary. Dr. Atherton Seidell of the United States Public Health Service has added a metal drying reel to the outfit which is shown in the attached illustration. (Fig. 14.)

Microfilms are generally utilized by one of four methods:

1. By optical magnification, that is magnification with a reading glass, binocular microscope, or some other similar device.

2. Wall type projection, that is by projection in a 35mm projector in a darkened room on a convenient wall or screen. There are many 35mm projectors on the market at the present time which may be used for this purpose.

3. Use in a reading machine. A reading machine is simply a projector which incorporates the projection head, film mov-

ing device, and a light shielded screen which may be either translucent or opaque.

4. For making paper prints. The 35mm negatives, if carefully prepared, can be used to make very good projection prints back to original size. In fact, the best test for a good microfilm is enlargement back to original size without noticeable loss in clarity or definition.

In order to facilitate the handling and reproduction of originals of many types several accessories have been developed for use with the Photorecord. One of these is a book cradle, which has been previously described. Another is a motor compressor unit for high speed operation. This takes the place of the foot bellows and permits very rapid reproduction of documentary originals. When it is considered that 800 double frame or 1600 single frame exposures can be placed on a single 100-foot roll of 35mm film, the scope of this equipment may be understood.

Those interested in microphotography should consult the **Journal of Documentary Reproduction,** a technical quarterly published by the American Library Association, 520 N. Michigan Ave., Chicago, Ill.

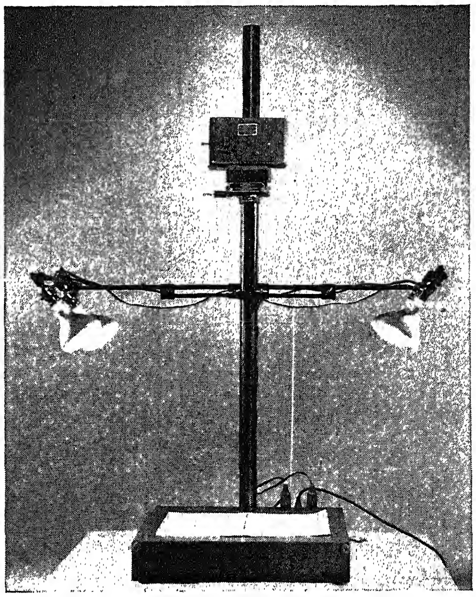
Documentary Reproduction with the Graflex Fingerprint Camera[1]

The Folmer Graflex Fingerprint Camera was designed originally for the use of detective and police officials in photographing fingerprints and other similar clues left by criminals at the scene of a crime. Within its limits, however, it may be used for the reproduction of signatures, stamps, seals, coins, medals, illustrations, and the like.

The camera itself is compact, measures approximately 12 x 7 x 6 inches overall, and is entirely self-contained, including batteries. A hinge plate covers the nose piece, which is about 2¼ x 3¼ inches in size. The camera is intended to copy exact size or one to one ratio, and is fixed focus. The lens is well corrected and operates at a fixed aperture of f/6.3. A ground glass focusing screen is supplied for orienting the image to be reproduced, and plates, sheet film, and film packs, size 2¼ x 3¼, may be used.

In operation the camera is placed over the object to be photographed and the exposure is made by an ordinary shutter operated by a lever. The shutter is opened by moving the lever to the central position, at which time the lights are turned on and the lever maintained in this position until the exposure is completed. It is then moved forward, the shutter closes, and the lever springs back automatically to the first position. The area covered by the nose piece will be photographed on the sensitive material in exact size and in correct focus. Although intended originally for the photography of plane surfaces, the lens possesses considerable depth of focus to permit the reproduction of objects in low relief, such as coins, medals, seals, etc. The average exposure with noncolor sensitive material is from 5 to 10 seconds, and shorter exposures with faster film may be made. It is possible with this camera to prepare overlapping negatives which can be printed, trimmed to size, and pasted together in the form of composite prints. Mr. Hoopes has been particularly successful in obtaining excellent reproductions of inscriptions, artifacts larger than 2¼ x 3¼ inches, etc., by this method.

While this camera will in all probability not be widely employed specifically for documentary reproduction, in the hands of amateurs and professionals interested in small size originals it is very economical and efficient.



17. Graflex Photorecord set up ready for operation.

[1] The writer is indebted for much of the material presented in this connection to Mr. Thomas T. Hoopes of the City Art Museum, St. Louis.

1. BALLET DANCER TAMARA TOUMANOVA. This and the following two pictures represent the simplest type of lighting technique by John F. O'Reilly. No effort was made for trick lighting. Emotion and composition were the uppermost thought in this effort. This dance picture was posed in front of a mottled tone background . . . illumination from 1000-watt flood on the floor with a 500-watt diffused front light. ½ sec., f:16, Medium Pan film. O'Reilly Photo.

ILLUMINATION AND ITS CONTROL

D. J. MOHLER AND R. E. WORSTELL

Illumination and its control are a vital part in nearly every step of the photographic procedure. Every photographer must necessarily know something about light, and the consistency with which he produces excellent pictures is almost in exact proportion to the perfection of his understanding of light sources and their control.

Even though this has always been true this essential understanding of light makes more and more demands upon the photographer with each passing day. Tremendous advances have been made recently in emulsions and papers. Light sources to take full advantage of the excellent characteristics built into these new materials have been developed and marketed. In order to keep abreast of photographic advances, the photographer's information must be complete.

It is impossible within the space of a single chapter on illumination to cover the subject with much adequacy. There are certain broad principles with which every photographer should be familiar, whether applied to the Graflex, Speed Graphic or any other camera.

The Graflex and Speed Graphic cameras are unique, however, in that they allow pictures to be made under a wide variety of artificial and natural lighting conditions. They are equipped with a focal plane shutter and the latter with the auxiliary between-the-lens shutter, both have ground glass focusing, they are designed for use with interchangeable lenses, and because of many other construction characteristics, they can be used for many different kinds of picture taking.

Controlled Lighting

Artificial light has one important advantage over daylight. It is entirely flexible, being subject to the control of the photographer both as to direction, quality, quantity, and balance. While this enables the man who understands light sources thoroughly to get exactly the effect he wants in his picture, it is an art that all photographers do not learn with equal ease. As in so many other branches of photography the best teacher is experience. The special lighting problems involved in such different fields of photography as portraiture, still life, banquet photography, press photography, sports photography, scientific photography, technical photography, and illustrative photography, have been too much for any one man to master. However, certain broad general principles of illumination apply pretty well to all fields and can properly be discussed here.

Single Light Sources

For the sake of simplicity one light source is often used to make a picture. When this light source is close to the camera and shining full on the subject we have what is known as "flat lighting," and in the resulting picture the shadows are scarcely perceptible and the light appears to have no particular direction. This lighting is most often used where the record is the most important thing, as, for example, in press photography wherein artistic result is a secondary consideration to getting the picture. Just as soon as the light is moved from its position near the camera, shadows are introduced into the subject and a wide variety of photographic effects is possible. If the light is held high and to one side of the camera a light similar to that seen outdoors in the sunshine will be had. If the light is held lower than the camera an effect similar to that given by stage footlights or by the light from an open fire will be had. If the light is held far around to one side of the subject, profile and contour will be emphasized. If the light is behind the subject shining on the background or shining on the subject and concealed from the camera alike, a silhouette of the principal subject will be recorded on the film. If the light is held directly over the subject, it gives an effect called "top light" which is sometimes useful in bringing out the pattern in glassware or in other special lighting applications.

The shadows introduced into a picture by using a single light source at any considerable distance from the camera immediately bring up a photographic problem. The contrast between the shadows and the highlights is not always desirable. As in many photographs some detail is desired even in the deepest shadows. To get some light into these shadows reflecting surfaces are often used. A better way in most cases, however, because it gives the photographer the maximum amount of control over the amount of light that he has in all parts of his picture, is to use a second light source.

11. Above picture made against a Trans-lux background. The effect of people in the wings was projected on the screen from a 4 x 5 negative and enlarged to approximately 10 x 12 feet. The dancer was posed in front of this screen . . . using a 1000-watt spot for illumination. 1/25 second, f:5.6, Fast Pan film.

Two Light Sources

Where two lamps are used the variety of photographic effects available to the photographer is almost unlimited. One light is used as a main illuminant to give direction to the shadows and an effect in the picture that the subject is illuminated from some definite direction. The second light is then used to fill in or illuminate the shadows so that the contrast in the resulting picture is pleasant. The position of these two lights depends entirely on the results desired by the photographer and upon his working methods as well as the use to be made of the print. In a broad general way the commonest lighting arrangement from artificial sources is perhaps one in which the main light comes in to the subject from a position somewhat higher than the camera and somewhat to one side. The fill-in or shadow light is on the opposite side of the camera and fairly close to the camera.

Multiple Lights

More than two lights are often used in commercial illustrative and movie photography. These additional lights are used independently for background illumination, for concentrated illumination of parts of the scene that might otherwise photograph too dark, for highlighting parts of a picture to which it is desired to draw particular attention, for back lighting where it is desirable to separate the subject from the background and perhaps to bring out the texture as in putting a highlight on the hair in a portrait, for cross lighting, for spot lighting, and for many other purposes where special illumination is built up to give a special picture effect.

In General

One of the persistent problems of handling artificial light is to keep the contrasts in the negative within the range of what can be printed on photographic paper. The eye is a poor judge of the relative brightness of various parts of the scene to be photographed. Little trouble will be experienced when using equal sources if no light shining on the principal subject is more than twice as far away as any other lights shining on the subject. It is perhaps not as well known as it should be that light falls off rapidly as a lamp is moved farther and farther away from a subject. If a lamp is shifted so that distance between it and the subject is doubled, only one-fourth the amount of illumination will reach that subject. Also, not so well known as it perhaps should be, is the fact that the type of light source used contributes very little to the photographic result as compared to the judgment and control exercised by the photographer. A man who understands light sources can get a soft, subdued result with flashbulbs or a contrasty, brilliant result with a few 25-watt ordinary home lighting lamps, to take an extreme example.

Most of the flash pictures that are seen have a characteristic flatness that comes from making the picture with a flashbulb in a reflector that is part of a synchronizer fastened to the camera. The main advantage of this system of lighting is that if the exposure is correct it always gets a picture because the light always falls full on whatever subject comes within the view finder of the camera. Because so many pictures, particularly press pictures, are made in this way, many people associate the characteristic flatness of the lighting with the flashbulb itself as if it were an inherent characteristic of the light source.

Many of the photoflash pictures appearing in national magazines are made with an extension cord as much as twenty feet in length running from the synchronizer socket to the lamp. Some of them are made with two or three flashbulbs all running from the synchronizer on extension cords so that they might be placed at various remote positions for a distinctive and sparkling lighting arrangement. The handling is exactly the same with constant burning sources such as photofloods, or regular studio lamps.

An observant study of the pictures appearing in our better magazines and newspapers shows an increasing tendency to make the most of the versatility of flash lighting by using one, two or more bulbs on extension cords to balance the lighting for maximum effect.

A good example of the advantages of multiple flash exists in the typical basketball shot. Even though the

photographer must be alert to catch a split second of action, he knows when making a picture of this type that his action is going to occur right at the basket so that he can have an extension cord running along to one side to place a flashbulb right under the basket with another bulb right on his camera. When the players jump toward the basket and the exposure is made, he gets full illumination on the front of every face and is able to get detail and expression that would not be possible with a single lamp fastened right to the camera. This is particularly true in a shot of this kind where the figures are spread over an area of 20 or 30 feet in depth and those in the foreground are almost certain to be more strongly illuminated from a bulb at the camera than those in the far background. With the side lighting on an extension cord, however, even those players in the background receive a fair degree of illumination.

For posed shots such as fashion photography, illustrative and commercial work, etc., where an exact lighting balance is desired, the procedure is to set up reflectors on tripods and standards and balance the lighting with continuing burning sources such as photofloods. In this way the effect can be observed visually. When the lights are exactly right they are turned off. The continuous burning lamps are unscrewed from the sockets and replaced with photoflash lamps all connected by means of extension cords to a synchronizer. This allows the subject to pose in the subdued room lighting which makes for comfort and naturalness. The swift, synchronized, multiple flash stops action and gives perfect wire sharpness to the picture that is desirable when it is intended for printed reproduction.

III. MOTHER AND DAUGHTER. "I have deliberately avoided using pictures which have not served a purpose in the magazine and advertising field," states John F. O'Reilly, "because I have been asked the following question more than any other . . . 'why was that picture made?' I believe every person must have a purpose in what he does, no matter whether it is commercial or personal. I wanted to make some pictures that would satisfy me, didn't care about dead-lines or reproduction screens. The result is that I went on a camera spree and produced these pictures of the dancer Tamara Toumanova." The above picture, which is made in the spirit of a Degas painting, was posed in front of a rust red background. Two 1500-watt floods were used. The key light placed to the right of the camera without a diffuser and the hot spot of the flood was carefully placed to accentuate the white of the costume and leave a shadow under the umbrella for emphasis. At the camera a diffused flood was used to relieve the shadow area near the camera. ½ sec., f:16, Med. Pan film.

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Actual Illumination Results

Some of the general principles of illumination can be shown in the accompanying photographs. In Figure 1 we have a miniature representation of a typical lighting set-up in which a doll is used to represent the subject and a miniature dummy camera and lighting unit are shown in position for picture making. In Figure 1 the light is shown beside the camera exactly where it would be placed were a picture to be made by means of a flash synchronizer attached to a Speed Graphic.

Figure 2 shows the effect obtained. Here is the kind of shot you have grown accustomed to seeing in your daily newspaper. For record photography or where time is a major consideration, as in present-day press photography, this kind of lighting is excellent. With correct exposure and careful development and printing such photographs can be interesting as the modeling and highlighting is very subtle. The eyes always show a single sparkling catch light.

A slight modification of this lighting arrangement is shown in Figure 3 where the light was moved around to about 30° from the camera. Many photographers using synchronized flash have an extension cord running to the reflector so that the lamp can be moved to various positions to either side or above or below the camera where quick photography without flat lighting is desired. Picture 4 shows that the 30° light produces some modeling by illuminating one side of a subject's face more strongly than the other. The other side of the face is in rather deep shadow. Also noticeable is that the actual shadow of the subject on the background has been thrown far enough to one side to be kept out of the final print if a small portion of the negative is printed.

Figure 5 shows how a single light may be used to produce a really pleasant modeling whether the subject be a person or an inanimate object. The light has now been moved around to about 45° from the camera and almost level with the subject's face. A light surface such as a sheet, piece of paper, or a light wall has been made a part of the arrangement so that some light can be reflected back into the shadowed side.

Figure 6 shows the effect obtained in this way and is certainly a pleasant variation of Figure 4.

The lighting arrangement in Figure 7 shows what can be done if a long extension cord is used from the flash synchronizer or if a single lighting unit containing a photoflood bulb is placed in this position. The light is strongly directional as shown in Figure 8 and the effect is one that in itself has only occasional use. However, a modification of this arrangement as shown in Figure 10 in which a reflecting surface has been brought in on the shadowed side, will produce a photograph like Figure 9. This same general effect can be produced by using a window as a main light source when a photograph is to be made in a room, bringing in a reflecting surface on the shadowed side or using a photoflood or a photoflash lamp to illuminate the shadowed side of the subject.

Figure 12. In this arrangement the light is again at an angle of 30° out from the camera but has been dropped to about 45° below the level of the camera. This is an interest-

ing way to get a fireside effect with a single light source, or the effect is similar to that seen on the faces of people acting on a stage where strong footlighting is used. Like the full 90° light it is a special effect which has limited use but which gets interesting results where its application is called for.

Figure 14 shows an arrangement which will produce what is called a "natural" effect. Outdoors in sunshine or in a lighted room the light generally strikes an object from overhead casting the characteristic shadows shown in Figure 13.

A more severe use of top light is shown in the arrangement of Figure 16 which produces the effect shown in Figure 15, with strong shadows under the eyes, nose, mouth and chin. Although not very useful for the photography of people, this lighting will produce an excellent effect in still life photography, particularly with glassware or other highly reflective objects where it is desirable to bring out the pattern without annoying reflections straight back at the camera.

Figure 17. This is simply the 90° light with the subject turned profile to the right bringing out the point that a lighting arrangement consists of three basic elements, the camera, the light, and the subject itself. Any one of the three may remain fixed, the other two being varied to create a particular effect. It is always interesting to set up the subject and the lights and to move about with the camera and study the effect from various angles or to set up the camera and the lights and have the subject moved from side to side or up or down, to get the best possible effect under the existing arrangement.

Figure 18 shows the effect of the 90° light on full profile. In Figure 19 is a simple lighting arrangement in which no light falls directly on the subject. A light-colored background is used and the illumination falls full on this, producing a crisp silhouette as seen in Figure 20, where profile is the important thing. This kind of lighting may be used and if some slight detail is desired in the subject, a weak light source near the camera will get it.

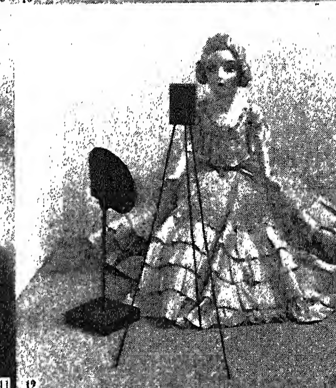
Figure 21 shows how two lights may be used to get a balanced effect.

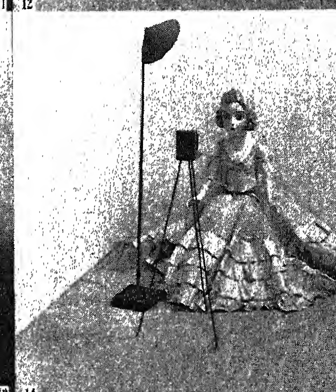
Additional Lighting Methods

The foregoing discussion by no means exhausts the possibilities with one light source. There are many photographers who seldom use more than one light source yet who are able to get an effect similar to that had with two or even three light sources by means of careful positioning of the unit and by the use of reflecting surfaces.

The use of two light sources, whether synchroflashed by means of extension cords running from the camera, or photoflood by means of individual lighting units, increases immeasurably the number of effects the photographer can get and the flexibility with which he can work.

In Figure 21 one unit is shown about 45° to the left of the camera and fairly close in. The other is about 45°





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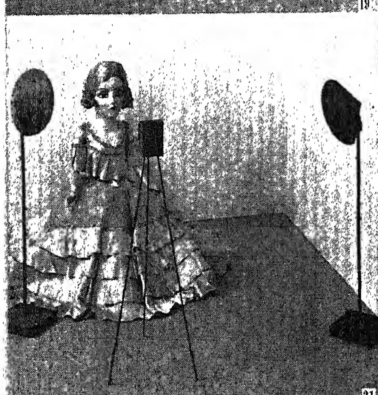

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around to the right and about two times as far from the subject as the first unit. The effect is as shown in Figure 22 with the directional light from the first unit highlighting one side of subject's face and the shadows nicely filled in on the other side by the second unit. The double catch lights from the eyes are a reflection that some photographers do not like. However, in photographing smooth materials of complex shape such as metalware or glass these reflections often give a brilliance that is desirable.

With two sources back lighting becomes easy as shown in Figure 23. Here one unit is at about a 45° angle from the camera to illuminate the subject. The second unit is clear around in back of the camera and high. When used in this way some means of shielding the direct light of the back lighting unit from the camera lens must be employed. A piece of dark paper will serve or a long accurate lenshade on the camera will accomplish the same purpose. The effect is shown in Figure 24. The back lighting has served to illuminate the hair of the subject quite prominently. Heavy shadows are visible on the lower portion of the face. These may be eliminated by means of a reflecting surface as shown in Figure 26, and a comparison of the effect produced this way in Figure 25 with the picture made without a reflector (Figure 24) shows the difference in the result.

A second light source may also be used for independent background illumination with an arrangement like that shown in Figure 28 where one light at about 45° is used to illuminate the subject's face, a reflecting surface on the opposite side is used to fill in the shadows and the second lighting unit is concealed behind the subject, shining on the light-colored wall. The effect in Figure 27 reveals that the background is perfectly plain without any cast shadows.

A modification of this arrangement is shown in Figure 30 where a 90° light is used, the subject's profile being turned directly toward that light. A reflector puts some detail in the shadowed side of the subject and the background is illuminated separately. Somewhat of the effect shown in Figure 29 is possible; with a light colored background to work with it is possible to dodge in the corners of the print prominently during printing or control the tone of the background by dodging and shading to suit the purpose of the picture and the desire of the photographer.

Figure 32 shows how the absence of background illumination produces an entirely different effect. Here although the same light-colored background is used, no illumination falls on that background. Two 90° lights are used, one just a little closer to the back of the subject than the other. This puts a brilliant highlight on the hair and brings out the detail crisply as shown in Figure 31. Where it is desirable to reveal texture on both sides of the subject at once, and where cross lighting will not create undesirable shadows at the central part of the subject, this set-up is useful, as for example in taking a picture of a model to bring out the details of her coiffure.

A little experimentation with photoflood lamps will lead the photographer to the discovery of the possibili-

ties of these lighting arrangements for his own purpose, and will open up the whole field of lighting for the discovery of lighting arrangements that suit him particularly.

It has been emphasized that by means of extension cords, all of these effects may be had with flashbulbs as well as with floodbulbs. Modern flashbulbs have low current consumption, quick burnout filaments which allow two or more bulbs to be used safely on any modern synchronizer employing standard flashlight cells.

Special Photographic Lamps

A great many different lamps are used for photographic purposes. The manufacturer keeps the use to which these light sources will be put carefully in mind when they are designed and when they are manufactured. Some lamps are almost single purpose lamps in that they are so made as to work best with one particular emulsion. Whenever specialized photography of any nature is undertaken, it is wise to consult the maker of the film material to be used as well as the manufacturer of lamps to determine which combination is best suited to the purpose in mind.

For example, there is a complete range of Mazda lamps which deliver a light of 3200° Kelvin color temperature at rated volts. (See PHOTO-LAB-INDEX page 254). They are designed for use with professional Kodachrome Type B. There is also a line of high efficiency lamps of 3380° K color temperature designed for use with a special medium-blue filter to give approximate daylight characteristics. Employed principally for Technicolor photography, they may be used with any color film requiring light the color of daylight (see PHOTO-LAB-INDEX page 249). All flood lamps are designed for use with amateur Kodachrome Type A, as are flashbulbs, although these latter have a slightly higher color temperature (3800° K) and for the greatest accuracy in results a slight correction with a suitable filter over the camera lens should be made. Wratten No. 2A for Kodachrome, Type B, Kodachrome Filter for Photoflood for Kodachrome Regular (daylight) Filter (3800° Kelvin).

There is no space here to dwell at great length on the characteristics of any great number of photographic light sources. However, the commonly used sources . . . flashbulb and photoflood . . . have a wide distribution and an everyday use. A very complete description of flash lamps and their use will be found in the chapter covering Synchroflash Photography. Some of the important things to keep in mind about flood lamps are as follows:

Photographic Flood Lamps

Photographic flood lamps are a family of high efficiency lamps with maximum light output for the current used. They are portable and lightweight. Two to three times as effective photographically as standard lighting


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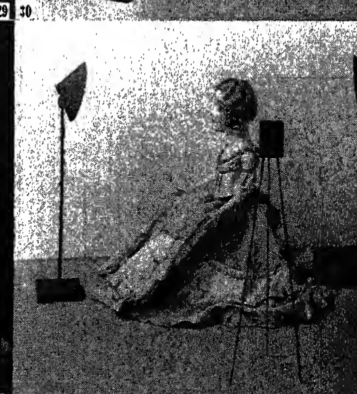
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lamps of equal wattage, the increase in color temperature makes the light more nearly approaching white. Their maximum photographic effect is on Pan films. Their color temperature matches that required by Kodachrome, Type A at 115-volts without a filter. They are also available in a line of daylight-blue bulbs approximately matching Kodachrome Regular without a filter.

With the new high speed films these lamps make snapshots possible with the simplest types of camera. (See Exposure Table). The amperage ratings of flood lamps are such that six of the No. 1 size or three of the No. 2 size may be safely used on ordinary house circuits fused for 15-amperes. Photographic effectiveness varies considerably with variations in voltage of the current supplied to the lamp. On Panchromatic film for example, if the effectiveness is taken as 100% at 115-volts and falls off to 73% at 105-volts, it goes up to 116.5% at 120-volts. Useful life may be prolonged by operating the lamp at reduced voltage by means of a resistance, series parallel switch, or adjustable voltage transformer while focusing or during preparation.

Color Temperature

With the rise in popularity of color photography it is increasingly important that the photographer be able to know and, if possible, to control the color temperature of the light used for a given color process. Color temperature is merely a convenient means of indicating the color of light. It has been defined as, "the temperature of a black body which has the same integral color as the source studied." This sounds rather formidable. But so would the definition of a degree Fahrenheit. All photographers, however, use degrees Fahrenheit quite freely and with a fairly good conception of its meaning. The same should be true of color temperatures because the color of the light is the all-important factor in color photography. Accurate reproduction of the subject in color is almost entirely dependent upon having light of a color for which the film is balanced. "Black-and-white" emulsions, too, are affected by color of light.

The following table will enable the photographer to obtain a basic understanding of relative color temperature values.

Source of Visible Radiation	*Approximate Color Temperature*
Hot iron, color barely visible	800°K
Hot iron, "cherry red"	1250°K
Candle flame	1900°K
500-watt tungsten lamp	2980°K
Direct sunlight	5400°K
Daylight (combination of direct sunlight and skylight)	6500°K
Daylight-Blue Sky-Sun hidden	7800°K

Chart on page 157 shows graphically the spectral energy distribution in the visible region of three sources of illumination. It is to be noted that as the color temperature is decreased, the proportion of red-orange light is increased with a corresponding reduction in blue-violet light. An understanding of this phenomenon is essential in color photography. The photographer who has a working knowledge of the spectral distribution of the various light sources will find it to be invaluable in aiding him to make an intelligent selection of "black-and white" emulsion for a given job.

Since tungsten filament lamps follow "black body" radiation characteristics, it is possible to express the color of light emitted in degrees Kelvin. The color temperature of a given lamp will depend upon the efficiency at which the filament operates and to a lesser extent upon the filament construction. The higher the efficiency the higher will be the color temperature. Color temperature values for several well-known lamps are given in the chart on page 156.

How to control color temperature is the problem faced by many photographers. Since color temperature of a tungsten filament lamp is increased with a rise in voltage and decreased when the voltage drops, control of the voltage gives control of the color temperature. If the color temperature of a given lamp when operated at its rated voltage is known, curve No. 1 will give the approximate color temperature at voltages other than normal.

In a permanent studio set-up, an engineering representative of the electrical utility from whom power is obtained should be consulted. He will be in a position to advise what voltage control equipment is necessary and to state to what extent the utility can cooperate.

One method of insuring constant color temperature is to use lamps of 100- or 105-volt rating and place a variable resistor in series with each lamp or with a group of lamps of the same type to make up the difference between the lamp voltage and the line voltage. The use of auto-transformers with variable control is another means of regulating line voltage. A fairly accurate portable voltmeter is a necessity when voltage control methods are employed. Another method is to measure the color temperature of the light source with a suitable meter (E. K. Co.) and adjust it to the color response of the emulsion by means of compensating filters.

Lighting Equipment

Reflectors serve two fundamental purposes—one of these is to direct the maximum amount of light emitted by the light source on the subject, and the other is to increase the apparent size of the source in order to create softer shadow outline.

An incandescent lamp or flashbulb emits light in all directions. If no reflector were employed, only a small percentage of the light generated would actually reach the subject. By redirecting light which would otherwise be wasted, greater efficiency in watts consumed relative to the light incident upon the subject is obtained. Increased efficiency results in the use of fewer watts and therefore, less heat and less equipment.

The sharpness of a shadow is a function of source size. The sun gives a very sharp shadow while an over-

cast sky gives no noticeable shadow. When a well-designed reflector is placed around a lamp the diameter of the light source is increased from that of the lamp itself, or in the case of a clear-bulb type from that of the filament, to the diameter of the reflector.

Reflectors may be divided into two general classes, floodlights and spotlights. The floodlight is the general-purpose unit and may be either a single or multiple-lamp reflector. A beam spread of approximately 60 degrees is considered correct. Illumination across the beam should be uniform and a "hot spot" in the center is to be avoided. For most work a sharp "cut-off" of the beam is not desirable in a floodlight unit.

Spotlights may be classed as special-effect units. This type of projector provides a concentrated, sharply-defined spot of light. It is used to localize illumination to a certain area, to highlight a subject, to produce distinct shadows or marked contrasts. Most spotlights are of the adjustable type and are capable of giving a clearly defined circle of light in the position of maximum concentration or maximum spread. The beam from a spotlight should have sufficient intensity to throw on part of the subject at least two to three times as much illumination as it received from other light sources.

Aluminum metal is the material usually found in photographic reflectors, employed as a reflecting surface. Its advantage over other material is its low cost, light weight, and freedom from color distortion. The reflecting surface may be polished, pebbled or unpebbled. Or it may be matte, ranging from a "velvet" finish to a heavy brushed surface. Reflector contour and finish, the position of the lamp in the reflector, and the light source diameter determine the reflector beam characteristics.

Lighting equipment in which the average Speed Graphic owner is interested should be flexible; that is, it should be portable and adjustable. It should be sturdy and at the same time light in weight. A consideration of these points and items previously discussed should be made in the selection of lighting equipment for photographic flash, flood and other tungsten-filament lamps.

Copy Board Lighting

The first essential of copy board lighting is uniform illumination over the copy. This may be accomplished by one of several lighting systems. Two floodlights used for illuminating the subject may be employed for copy board lighting if there is fairly uniform illumination across the beam. These should be located on floor stands or mounted on each side of the copy board and directed at the copy at such an angle that there will be no reflection of the light source off the surface of the copy back into the lens. Photographic flood lamps or other tungsten filament lamps may be used.

Several small lamps in trough reflectors are frequently used. Fluorescent lamps also lend themselves admirably to copy board lighting. If a "color blind" film is used for copying, the blue fluorescent lamp should be used; otherwise the daylight or white lamps are recommended. In order to obtain sufficient illumination for short exposures, two or three fluorescent lamps in trough reflectors on each side of the copy board may be required. Again, care must be taken that no reflected glare from the copy will enter the camera lens.

Photo-enlarging

The use of Speed Graphic cameras in the smaller sizes makes an enlarger a desirable addition. Enlargers are divided into two types—reflector and condensing lens. Both have their merits. It has been the experience of some photographers that the reflector type in which some form of diffusing glass is used between the lamp and the negative will give the best print where a negative is scratched or has lint or dust particles adhering to the emulsion. On the other hand, "wire sharpness" in the print is obtained from a condensing-lens type of enlarger. Naturally, there are modifications of both types available.

One of the first qualifications for acceptance of an enlarger is a uniformly illuminated field. The edges of the print should receive as much light as the central area. White bulb lamps are the most common illuminant for enlargers and the greater diffusion provided by the white bulb aids materially in obtaining uniform illumination in reflector-type enlargers and in some condensing-lens types. Mercury vapor "M" tubes, fluorescent lamps, as well as some special tungsten-filament lamps designed for specific types of enlargers are available. Fluorescent lamps, in particular, have extremely high photographic effectiveness, in some cases as high as 30 times that of tungsten-filament lamps.

Use of Fluorescent Lamps in Speed Graphic Photography

Space does not permit a detailed description of the fluorescent lamp. Briefly, however, it consists of a sealed glass tube, with a bipin base on either end. The external contacts are connected to electrodes in each end of the tube across which an arc is formed in the presence of mercury vapor. A low pressure mercury vapor arc of this type has relatively little visible light but a large amount of invisible ultra violet radiation. The inner surface of the tube is coated with a fluorescent material which is activated by the invisible ultra violet radiation into visible light. Various colors can be obtained by different combinations of the powders which make up the fluorescent coating. Those which are of interest to photographers are daylight, white, and blue.

Each lamp must be operated from its own auxiliary which consists of a choke coil and starting switch. Although designed for A.C. operation, fluorescent lamps may be operated on direct current with only a slight modification of the wiring.

Fluorescent lamps are available in lengths of 6, 9, 18, 24, 36, and 48 inches and are rated in watts at 4, 6, 15, 20, 30, and 40 respectively. Because of the fact that they are an extended, low brightness source, emitting but little radiant heat, they

are ideal for portrait lighting, and for many applications in the commercial studio.

The daylight lamp, which closely duplicates the spectral characteristics of daylight of a clear day in June, gives excellent rendition with both panchromatic and orthochromatic emulsions. The white lamp has about the same color as high efficiency tungsten-filament lamps and reacts accordingly with the various emulsions. The blue lamp emits nearly all of its light in the blue-violet region, the region in which "ordinary" emulsions and enlarging papers are sensitive.

Because of its shape, the fluorescent lamp is adapted to use in a trough reflector, a number of which may be assembled to form a bank. Also, because of its shape, it does not readily lend itself to the production of a "spotlight type" of beam.

The use of fluorescent equipment in portrait or commercial photography is fundamentally similar to that of regular tungsten-filament reflectors. The principal difference is in the distances, lamps to subject, which in the case of fluorescent may be much nearer than for other light sources. It has been the experience of some photographers that a total of 600-watts of daylight fluorescent, fast panchromatic film, enables portraits to be made with exposures as fast as 1/25 second. For mixing with or supplementing tungsten-filament light, the white fluorescent lamp is recommended.

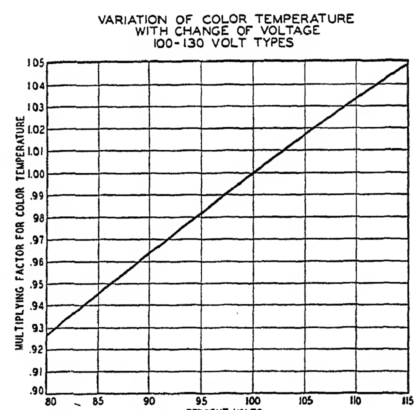
With a daylight lamp installation where a concentrated beam of light is required, a photographic blue bulb spotlight lamp in a spotlight will be satisfactory. Or a spotlight equipped with a clear bulb lamp and suitable medium blue filter in front of the lens may be used.

In regard to the use of fluorescent lamps with color films or processes, there is every indication that they will be satisfactory. It is possible that some slight amount of color correction by means of filters may be necessary.

LAMPS FOR USE WITH EASTMAN TYPE B KODACHROME

Nominal Color Temperature 3200°K
(Initial Color Temperature 3250°K)

Watts	*Bulb*	*Volts*	*Base*	*Burning Position*
5000	G-64	110, 115, 120	Mog. Bipost	Base down
2000	G-48	“	“ “	“
2000	G-48	“	Mog. Screw	“
2000	G-48	“	Mog. Prefocus	“
1500	PS-52	“	Mog. Screw	Any
1000	PS-52	“	“ “	“
1000	G-40	“	“ “	Base down or horizontal
1000	G-40	“	Mog. Prefocus	“ “ “ “
1000	T-20	“	Mog. Screw	Base down
1000	T-20	“	Mog. Prefocus	“
500	T-20	“	Med. Screw	“
500	T-20	“	Med. Prefocus	“
500	A-25 Inside Frost	“	Med. Screw	Any



33. Table showing color temperature values of a given lamp as described on page 154.

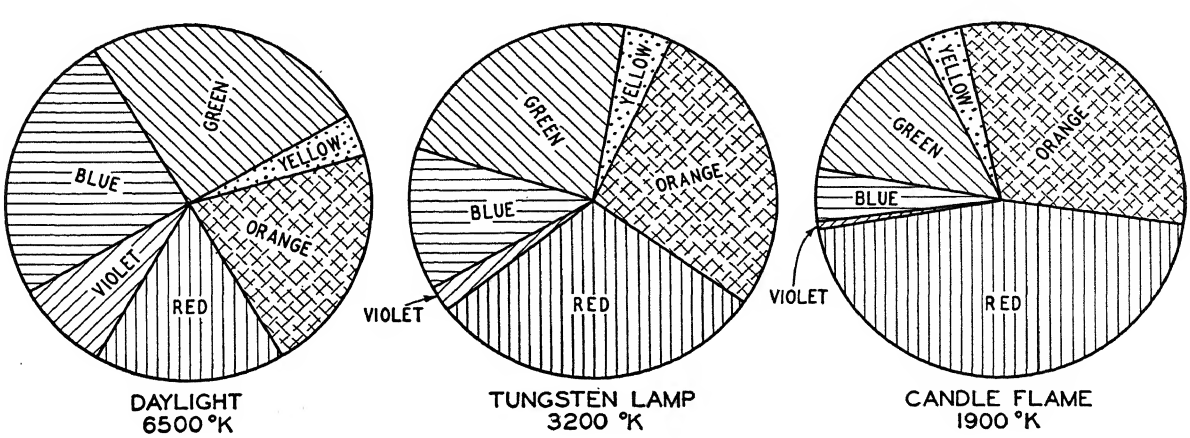
"C P" LAMPS (3380°K)

Watts	*Bulb*	*Volts*	*Base*	*Burning Position*
10,000	G-96	110, 115, 120	Mogul Bipost	Base down
5,000	G-64	110, 115, 120	“ “	“ “
2,000	G-48	115	“ “	“ “
2,000 (Movie-flood)	PS-52	105-120	Mogul Screw	Any

APPROXIMATE COLOR TEMPERATURE OF SOME COMMON TUNGSTEN-FILAMENT PHOTOGRAPHIC LAMPS

Watts		*Life* (*hours*)	*Color Temp.* (DEGREES K)
500	PS-40	1000	2980
1000	PS-52	1000	3000
1000	" "	250	3110
1500	" "	1000	3030
1500	" "	250	3150
500	T-20	50	3260
1000	T-20	50	3320
250	G-30 Spot	200	2970
400	" "	200	3060
1000	G-40 "	200	3150
250	Photoflood No. 1	2	3475
500	" No. 2	6	3415
1000	" No. 4	10	3380
2000	Movieflood	15	3380
Photoflash (Average of Total Flash)			3800
	APPENDED DATA BY THE EDITORS		
200	Superflood No. 1	2	3480
500	Superflood No. 2	6	3450
1000	Superflood No. 4	10	3400
Superflash (average of total Flash)			4000

SPECTRAL ENERGY DISTRIBUTION IN VISIBLE REGION



4. ST. MARK'S ON THE BOUWERIE . . . Berenice Abbott Photo. This picture illustrates a typical planned type of View Camera exposure. Additional explanation is given in the following chapter.

THE VIEW CAMERA

BERENICE ABBOTT

"Why is it upside down?" is a usual question of those who look for the first time at the image on the ground glass of a view camera.

The image is upside down because light rays cross as they pass from the object viewed through the lens and onto the ground glass.

"And what is the ground glass?"

The ground glass is a piece of glass the same size as the film or plate and placed exactly where the film will be. It is ground so that it looks frosted and semi-opaque. On the smooth side of the ground glass the photographer can see the exact image that will subsequently appear in his negative and print. Because this image is visible . . . can be viewed . . . the camera with a ground glass is called a "view camera."

The ground glass is not a range finder or a view finder. These parts of the hand camera show the image right side up, but very much smaller than it will appear in the finished photograph.

"Why should any one care whether the image is the same size as the picture will be?"

The answer is a long story, and the reason for this chapter. But briefly, the image should be the same size as the picture because, by seeing the image the same size as the finished photograph, the photographer can see all parts of his picture and through more accurate control . . . perfect it.

Early cameras were all view cameras. They were heavy and awkward to carry about; and so early photographic fans were delighted when enterprising inventors and manufacturers began to market smaller, more portable cameras. The folding hand camera was invention's gift to America's 18,000,000 photographers. Then, as the camera entered a new birthright in press photography, with its ever increasing demand for action shots, there came the era of cameras like the Graflex and Speed Graphic, great machines for their special work. But just as the motorcycle or Mack truck cannot meet all the needs of automotive transportation, so the fast action cameras cannot do everything photographers want.

Now after the flurries of several exciting decades, the view camera is coming back into its own. Of course, there have been photographers . . . fine ones, indeed . . . who never deserted the view camera, because they understood very well its basic qualities and excellences. But today thousands of amateurs, hobbyists and advanced workers join the trend to the view camera. This trend is toward the smaller view camera, say 3¼ x 4¼ inches or 4 x 5 inches, a compromise between the large heavy 8 x 10 view camera and the tiny easy-to-carry-around hand camera. A quick glance at the *U. S. Camera* annuals shows this: Technical data indicate that whereas in 1935 forty per cent of the photographs were made with small or miniature cameras using a negative size of less than 3¼ x 4¼ inches, today the figure has dropped to thirty per cent.

It is my turn to ask a question: "Why?" And to answer it.

Because for its own type of work the view camera cannot be excelled, and because it is unquestionably the best camera with which to learn photography no matter what sort of work one goes into or what specialized cameras one may need later on. This point is thoroughly borne out in my teaching experience at the New School for Social Research in New York City. Students entering the classes nearly always own a camera (often quite an expensive one) of the miniature type, or small folding hand, or even box camera. However, as they delve more into the mysteries and exacting demands of photography they want to change from the 35mm or 2¼ x 2¼ inch negative to larger sizes. This transition comes about inevitably because the student must finally know that making photographs well requires more work and more care than he has been led to believe by the rosy cries of how easy it is to snap, snap, without trouble, labor, or knowledge.

Optical vs. Human Eye Vision

To master photography one must train one's self to see as the camera eye sees. The optical vision is not the human eye's vision. Therefore, one must scale down the human eye's flexible and roving vision to the inescapable limits of optics, that is, of lenses. With the view camera, re-education of the eye is more readily accomplished, because as you look at the ground glass, you can see not only what you are doing, but also how you are doing it. You are not working blindly, but by focalization of the

All photos by Berenice Abbott

eye with the lens. This harmony between the human eye and the camera eye is the true photographic vision. It is the main thing in photography. By it the image is controlled. Thus the photographer does not merely aim and shoot and leave the picture to accident.

An additional reason for learning photography with a view camera is the economic one. A good view camera often costs considerably less proportionally than other types of cameras. The cost of operating a view camera, in my opinion, is no more than the cost of operating a smaller camera, strange as that may seem. For, although film for miniature cameras is cheaper, you take ten times as many pictures. There is always the temptation to finish the roll (any old way) to see what you caught.

Except for fast action work, more than merely aiming at the principal object is needed to vivify the principal object. Such vivification makes photography something more than a mechanical, snap-shooting affair. Here is the point where by visual means, the creative and constructive effort of the serious worker is made. Ignoring here the choice of subject, which is most important, we aim now to qualify our choice, to make it communicate to others the reasons which stimulated us to photograph it and to say pictorially what our interpretation of that subject is.

Why is this accomplished most successfully with a view camera? Focusing on one object can be as efficiently done with a good range finder as with a ground glass, although the human eye varies in this respect. But the range finder will not capture visually the depth of field in those pictures where depth of field is essential to create the desired effect. I stress the importance of effect in a photograph in the sense of portraying to the beholder one's interpretation of the subject even as effect is used in all other arts. Depth of field involves the relation of the foreground and background to the principal object of the photograph. The optical control of depth of field is an organic means of suggesting perspective; it evokes the sense of the three dimensions of space in which the real and solid objects of life, live and move and are photographed. A sense of distance, of atmosphere, is conveyed. The important objects of the picture are stressed by proper subordination, even by throwing parts of the picture out of focus to some degree. This carefully studied operation can best be achieved through the ground glass. Conscientiously practiced, there is no haphazard and uncontrolled depth of field.

Some small cameras are built with a distance scale to *measure* depth of field. But the ground glass is indispensable in training the eye to *judge* depth of field. For the built-in scale cannot be used intelligently unless the photographer has had previous experience in accurately directing the lens by the basic means of seeing the effects of depth of field on a ground glass.

Perspective has great value for dramatic pictorial effects and for accurate rendering. But it is imperative to control the result by visual means. The virtue of the view camera is that it permits the operator to see the image of what he is photographing in the ground glass. This conscious control of perspective cannot be overemphasized. Equally important with controlled depth of field and pictorial perspective is the framing of the area to be included in a picture; namely, composition. This function of composition is important because the picture must be contained within the four sides of its rectangle, whether it is contained in a tension of symmetry, assymmetry, dynamic symmetry, or whatever arrangement of forms, directions, movements, and rhythms pleases the photographer. The habit of seeing a picture within these boundaries is fastened upon us by the convention of pictorial art. It is absurd to defy habit patterns simply for defiance's sake. If a creative purpose is served by composing round or oval pictures, all well and good. But for the most part, we work within the frame of the rectangle.

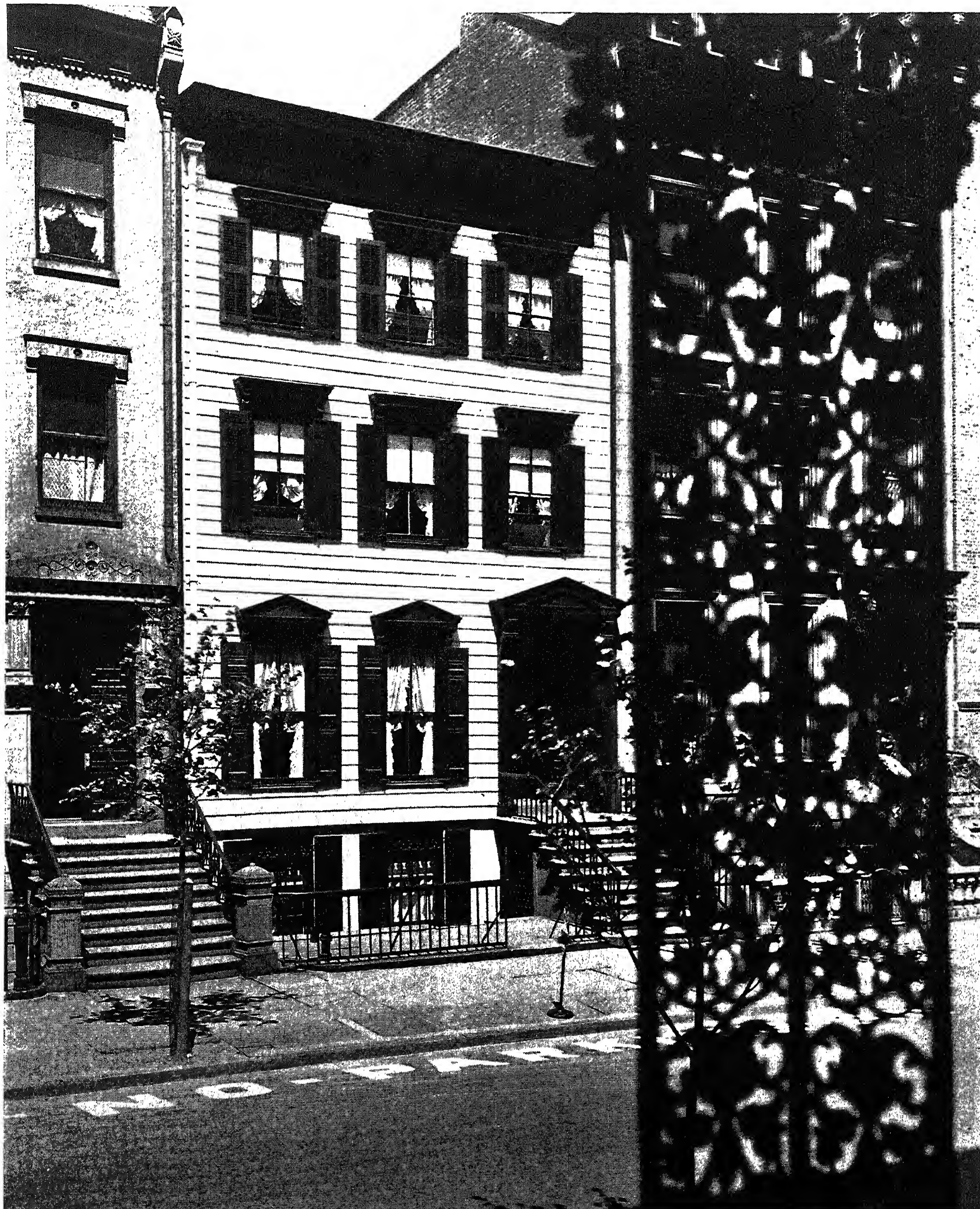
Too often only the center of the picture is considered, leaving the edges more or less to chance. Using a ground glass, the photographer, by moving the head opposite each part of the glass, and particularly the edges, can keep stray faces, cows and ends of branches from wandering into his picture; he can place his principal image wherever he wants it in the composition. If he is taking a portrait, he can arrange the face to be low on the plate, high on the plate, to one side or to the other. In the more complex problems of composition, as outdoor views with intricate architectural subjects, vehicular traffic and moving people, he can control the placing of his subjects more exactly than if he were shooting blindly.

View Camera Composition

Regarding composition, it is difficult to make set rules. The masters of pictorial art, whether they are painters or photographers, have never composed their pictures by slide-rule. To be sure, the reduction of pictorial art to descriptive geometry is tempting; but it represents an inorganic and mechanical, not to say uncreative, approach to design.

Moreover, with a ground glass, lighting can be judged better. The fact that the photographer sees his picture means that he will not have coy sunbeams edging into the lens, or ungainly shadows intruding on the main subject, or unbalancing the composition.

Seeing the image inverted is not a handicap. Choice of subject comes first, then scope of view or exclusion of irrelevant detail . . . all of which we do with brain and eye. And so, we come to the composing of the material by means of lens and ground glass. With the image inverted we can compose "abstractly," in a sense that the distribution of lines and light and shade in the composition are seen fully as well upside down, if not better. We



2. **WILLOW STREET,** Brooklyn, New York . . . Berenice Abbott Photo. There are occasions when the eye should be directed toward the center of interest by throwing out of focus portions of the picture which have a lesser interest. In this case the foreground grill is slightly out of focus. The exact composition can be seen on the ground glass of the View Camera before exposure.

may say that we "compose" without the intrusion of "subject," that is, we can, for the time being, forget the subject and think of its design.

Composition is an organic part of the subject matter of any pictorial medium, as closely knit into the picture as veins and muscles are woven into the fabric of the human body. Take away subject matter, and composition becomes meaningless, a tour de force of technical virtuosity. Take away composition, and the most excellent subject matter is robbed of a part of its ultimate significance.

Without composition, a picture lacks eloquence, as an orator fails to move his audience if he cannot speak clearly and coherently.

Through composition you can create the effect you want, whether psychological, esthetic, documentary, historical, scientific, pictorial. Subtle though the difference is, we all recognize that one picture is expressive whereas another picture of the same subject is dull and uninteresting. The artist (photographer, painter or what) has placed his figures, his buildings, his mountains, his trees, his waves, his skyline in interesting and exciting relations; in other words, he has composed his picture.

What exactly does this mean? Are there rules for composition? By what lessons does the photographer or any other kind of picturemaker learn to say what he wants to say?

We may as well ask how the novelist, dancer, architect, learns the grammar of his medium. We all can learn the facts about a medium . . . what its basic materials are, how these are used, what formulas achieve results. But when we begin to ask what makes the difference between the creative practitioner of a craft and its thousands of amateur devotees, we run up against the old mystery of what is creativeness. It is no help to the beginner or to the sincere amateur to answer that experience teaches the difference.

In photography we strive for "effect," within the boundaries of the photographic medium. In writing and acting, this is equally true. The great actor knows how to control and to discipline his delivery so that the climax of dramatic "effect" is reached when it best serves the dramatic action. The great writer or the great painter leads his audience up to the point where they have no alternative except to share his emotion and his ideas. This is as true of photography as of any other medium.

Suppose you wish to photograph the skyscrapers of downtown New York. You want to be fairly close, so that the overtowering scale of their thousand-foot-high walls will be evident. At the same time, you wish to show a wide panorama of these colossi, in order to create the effect of magnitude, of physical power. You must therefore use a wide angle lens. But the greatest angle you can take in covers only a part of the panorama. Confronted with this problem, you must decide what ele-

3. EXCHANGE PLACE. If subject calls for an unusual shape or format do not hesitate to crop the picture accordingly. Berenice Abbott photo.

ment is most important to the effect you wish to create, what effects will most certainly evoke the emotions you wish to arouse.

How much of the scene you see is to be included in your composition? That is, in the picture you see upside-down on your ground glass, where shall the picture begin, where to leave off? As a photographer you must rely on your understanding of many factors, such as distribution of lines, of lights and darks, balance, unity.

With the skyscrapers, your decision will depend on your interpretation of the subject you see. You may see the skyscrapers as beautiful and superb, the final masterpiece of architecture in the twentieth century. They may appear to you as ugly, inhuman, illogical, ridiculous, the negation of a humane scale of life and the superimposition on human beings of a quantitative standard of existence. Surrounded by these dark and windy canyons of steel and glass and stone, you may long for the vast expanses of plains or the precipitous slopes of mountains, for earth uncontaminated by man's activity.

Whatever you think or feel about the skyscrapers, you will need to know how to say it in terms of visual art, not in words, if photography is the medium you have chosen.

Thus you may make the vertical lines topple toward each other or fall part, so seemingly ready to collapse. Or you may "compose" them so that they sway in orderly rhythm expressing an integrated strength. What you decide to "say" by means of composition depends on your experience in life and your ideas about the usefulness of photography in life; for no two photographers see exactly alike. But you will not be able to play on the minds and feelings of the people who look at your photographs unless you have this fundamental understanding and control of your medium. In a very real way, it is like music: the public does not necessarily have to know anything about counterpoint and harmony and instrumentation, but the public surely responds to the mood and intention of the composer.

How do these principles apply specifically to the view camera? Does not the photographer need to compose his photographs whether he uses a miniature camera, folding camera, or what? Of course. Only, with the view camera, he has a greater latitude, a surer vision of what he is doing, a better chance of controlling his result.

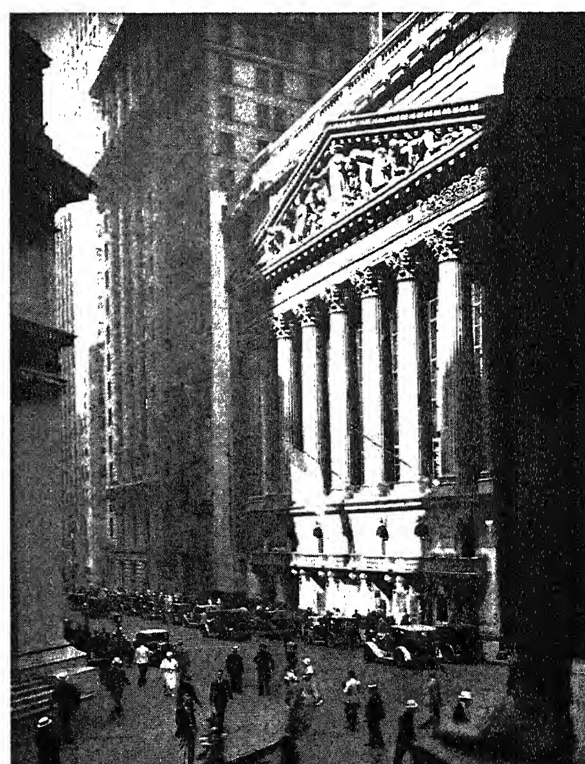
This lies in the fact that composition in a visual medium, such as photography, functions in visual terms. Now the ground glass is first of all a structure by means of which the photographer is able to see what he is doing. Seeing in this case means not only a crude sighting at an object . . . as merrymakers sight at the targets in shooting galleries . . . but also that somewhat nebulous and intangible act of the artist whereby he envisions in imagination the picture he will later resurrect from developing tank and printing frame.

Such is the role of imagination in all the arts: to transmute observed fact into reality, to endow it with overtones of its accumulated experience. Here the photographer needs to know all he can, not only of technique, not only of the abstract quantities called esthetics, but of a great range of human interests and activities.

For though you cannot create the subject itself, you can choose which subject you will photograph, and you can choose your point of view. On the richness of your experience, on the breadth and generosity of your interests, will depend what subject you choose and what point of view you take.

Then, at the point of putting your vision into practical effect, you reflect your attitude by organizing the subject in a given space, the ground glass. The subject must live within the framework of the photographic rectangle. In the rectangular ground glass (upside-down) you may study the subject, shift it about, relate it to a thousand minor elements, distort it, bring it close or push it far away. All these actions will create varying psychological states in the beholder; by whichever you choose, you will direct the thinking and the feeling of your spectators about the subject.

For example, you may create the emotion that a scene is in prison by bringing its edges tightly to the edges of the ground glass. You may evoke a strong vertical or horizontal tendency by the way you place lines and



4. STOCK EXCHANGE, NEW YORK. Shows use of lateral swing front to bring foot of statue into sharper focus without stopping lens down too far. Abbott Photo.

strong simplified masses in a rectangle. You may play dynamic rhythms of moving crowds in a street scene against each other to re-create the sense of pace and haste that is one of the city's most dominant characteristics. You can make a picture soar by the way in which your composition leads up inescapably to the sky, or you can keep it earth-bound and inert.

A Few Principles of Composition

Composition is an organic and intelligent approach to the problem of saying what you want. It cannot be reduced to a mere mathematical formula, as we have said before. Nevertheless, a few simple rules . . . applied with a grain of salt . . . help the beginner. When there is a good reason for breaking a rule, do not hesitate to do so.

1. Do not be led astray by rich color in your subject. The photograph must register in values of black and white.

2. The principal subject should not be placed in the mathematical center of the ground glass.

3. Generally, the horizon line should not be in the middle of the ground glass, but above or beneath the middle.

4. Decide if you want your picture to be a horizontal or a vertical. A vertical composition (such as one almost instinctively uses when photographing trees) gives an effect of height, strength, dignity. A horizontal (such as one is induced to use in photographing a view of ocean waves and beach) gives the mood of repose. For practical purposes this decision is made by factors inherent in the subject itself, that is, by the dominant direction of the main lines of the picture.

5. Dominant lines may be relieved by secondary lines in opposite directions; this prevents monotony or instability. A mirror-like ocean may be monotonous, but a sail slanting from the water serves to break the horizontal tendency and give relief.

6. Not only lines, but also lights and shades need to be balanced. A large shadow should be relieved with a light area of another shadow of lesser intensity. Correct balance of light and shade unifies the photograph.

7. Chief parts of a picture are principal subject, foreground and background. The subject is the center of interest and as such should attract attention at first glance. Other parts should serve to enhance or reenforce the interest of the main theme.

8. The subject should be the composition's center of unity. There should not be two or more motives of equal interest.

9. If the main subject is far away, introduce elements of interest into the foreground so that it will not be dull. A bush, rocks, a person, a chair, a wagon will serve.

10. If a third or more of the picture is sky, harmony forbids that it should be a blank, white area. Use a light yellow filter and increase exposure by one-half. The sky will then be a light gray instead of a flat white, and white clouds will give relief, as well as enrich the composition.

11. Placing of figures and objects is important. If a per-

5. YOUNG SPINNER IN A CAROLINA COTTON MILL: 1908 by Lewis Hine. Hine's View Camera study of child labor in a Southern Cotton Mill depends for a heightened emotional impact on the subtle relation of parts—bobbins on a long frame, the round-shouldered child and the dreary stretch of machinery interacting to make a poignant and beautiful human document. The edge spacings are balanced and not monotonous. The long row of bobbins, receding into a distance, the most prominent ones out of focus to guide the eyes to the center of interest which is the child. The conflict of forces within the composition is comparable to the conflict of values signified by child labor.

6. **PLANTS** by Eugène Atget (Courtesy Berenice Abbott). Atget's composition, made with a View Camera about the year 1908, is founded on an intuitive perception of the organic harmony of growing plants. The repetition of a form but one subordinated to the principal plant — the strange, spikey leaf — in a number of sizes and positions is ineffably pleasing to the eye, because it evokes a sense of familiarity, that these are well-known and well-loved objects. Sunlight falling on some leaves and leaving others in deep shadow prevents the repetition from becoming monotonous.

son is looking off in one direction, leave more space in front than in back. The eyes must have space to look into.

12. To make a figure look tall, place it high in the composition. To make it look small, place it low. Never crowd a stout figure into a small space, unless you deliberately wish to accentuate the impression of weight and size.

Action And The View Camera

There is a notion that the view camera is "static" because it cannot stop motion to the extent that action cameras do. This too is a mistaken conception. The still photograph is NOT a moving picture; and even moving pictures have their limitations. If still photographs were chronically out of focus as moving pictures are, we would take no delight in them. The moving picture's blur, however, is a necessary characteristic of its technique.

The still photograph's prime characteristic is that it has stopped motion, not that it has simulated motion. Its convention is the pictorial convention of two-dimensional representation of three-dimensional solid objects. Another dimension, movement, has been added and must be suggested within the framework of the two-dimensional print. So whether a photograph is static or dynamic does not depend on an illusion of movement, but on its plastic solution of its problem. The dynamics of composition are not solved if the lens stops a pole-vaulter's figure in mid-air; the dynamics of the picture result from an interplay of forces, and these visual materials must be captured and reproduced by the camera. Not the camera, but the photographer will determine whether a still photograph is "static."

Actually there is little static material in life—and photography is no different than life. Static themes involve such sad states of the brain as stagnation, blind imitation, chronic frustration or resignation. But a still object can be as dynamic as a volcano. Proof is the emotional impact of an apple painted by Cézanne, or of a white rose photographed by Atget.

Above all others, the view camera is suited to register the solid foundations of realistic subject matter and to anticipate the addition of whatever activity, movement or human gesture may relate itself harmoniously to the subject. By forethought, the photographer can make the picture more interesting, more amusing, or more abominable. For abominations flourish everywhere in the world today. They are visual in nature and offer themselves to our vision—indeed, cry out for our comment, unless we are to become as ostriches and photograph only snow scenes, gray shrubberies, rustic bridges, reflections in puddles.

The truism "The view camera is not as fast as other cameras" has been exaggerated. Setting-up exercises for the view camera involve a number of steps. The view camera's relative "slowness" is compensated by the fact that since the negative will not be enlarged as many times as the smaller miniature film, it does not have to have the excessively meticulous detail indispensable if the tiny film is to be enlarged at all. Since the adjustments of a swing back or front can be used with a view camera, speed is gained here too, because the lens does not have to be closed down as much as would be necessary with a hand camera. Moreover, with a small camera, if minute definition is needed over the entire film to permit enlarging, the lens usually has to be stopped down to a smaller aperture than would be necessary for a larger camera, so that a longer exposure is made. This is not true in the case of a few relatively fast anastigmatic lenses where excessive flatness of field has been incorporated in the lens by the manufacturer.

These factors partially cancel each other. But a further point may be made: A rather blurred object in a large negative will make a passable contact print, but a blurred object in a tiny film enlarges badly.

I have discussed at length the field in which the view camera functions best, because photography is primarily a matter of making decisions or choices, of determining to take one kind of photograph and not another. As photographic objectives are mutually exclusive, so are the cameras with which photographers work. Yet to my mind, the advantages of the view camera far outweigh its disadvantages. No other kind of camera can achieve the extraordinary definition of detail obtained by the view camera, properly handled.

Definition is the superb quality of photography. By the fidelity with which flesh, hair, fabrics, wood, bricks, stone, steel, earth, bark, are rendered in the photographic negative and print do we receive the shock of reality. If flesh looks like sand in a photograph, no longer do we believe in the validity of the recorded image; the historical and documentary character of the photograph has been lost.

Now with the view camera one does not render flesh to look like sand or like mush, as often textures are rendered in the coarse grain of inexpert enlargements. It is possible to suggest the worn, weathered look of skin, the luminous leaf of a white rose, time's erosion of old buildings—because the structure and the functions of the view camera permit the photographer to see precisely what he is photographing and how he is photographing as he goes along. All photographs which have enduring value have the common denominator of good definition. Whether they are photographs by Brady, Hill, Nadar, or Atget they are marked by definition of a penetrating quality.

Importance Of Focusing

Correct focusing is an indispensable step in using the view camera for best results. After you have draped the focusing cloth over your head and squinted at the up-

side-down image in the ground glass, what then? Actually it takes practice to focus sharply. The newcomer to the view camera may believe that the image is sharp in the ground glass and then be vastly disappointed when the photograph is out of focus. To avoid disappointment, learn to look all over the ground glass, not only at the center. Hold the head about a foot away, keeping out light with the focusing cloth. Move the head so that the eyes are directly opposite each corner and edge and part of the ground glass. Make this practice habitual; it will help you to get all your pictures in focus, and also aid in your compositions. If you look only at the center of the image, you are likely to be surprised to find accidental faces, table edges, balustrades, telephone wires that have strayed into the picture.

Focus on the center of interest; if a portrait, on the eyes, catching the highlights in sharp focus. If the subject is dark and visibility poor, the lightest object in the same plane as the center of interest can be used for sharp focus, racking the bellows back and forth until the sharpest point is obtained. In a dark interior where a wide angle lens may be used with its corresponding small opening, it is a great help to focus on a lighted match, candle, flashlight, or electric bulb.

Mechanics Of The View Camera

Having outlined the advantages of the view camera, we may now take a look at it. The view camera must always be used on a tripod. The importance of having the camera perfectly still and firm is obvious. Technically speaking, the first consideration in photography is to have the image sharp. This camera is a light-tight box, as any camera is. It differs from other types of cameras in that a ground glass has been built into the end of the box where the film is placed. The four corners of the ground glass are cut off to allow air to escape as the

7. BARCLAY STREET FERRY: 1930. Berenice Abbott Photo. The busy life and action of the ferry station are echoed in the rhythms on which the composition is built. The sharply converging lines of the cross-walks down which pedestrians hurry, the gentler obliques of the buildings and piers, repeated in the rows of freight cars on barges, are contrasted to the strong horizontal pull of the rivercraft seen in the distance. In the tension between these uncompromising directions, the photographer recreates the activity and tension of the subject. 1/25 second, early morning, Superpan film.

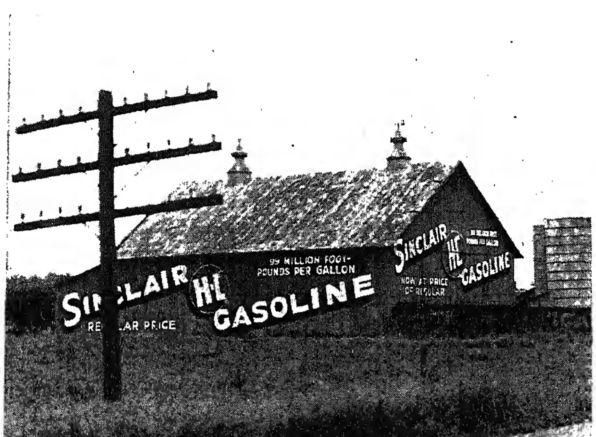
bellows are closed. If one were careful to remove the entire back when compressing the bellows, the four corners of the ground glass could be left intact . . . enabling the operator to see to the very corners. The advantage is apparent as we have explained previously in this chapter, the importance of seeing the image to the very edges of the rectangle.

The collapsible bellows permits the camera to be folded compactly. The longer the extension of the bellows the more flexible the camera. Lenses of different focal lengths can be used, wide angle as well as longer focal lengths and telephoto lenses. The longer the focal length of the lens the longer the bellows. The longer bellows extension on a good view camera is a great advantage over the best folding hand camera. Such an extension makes it possible to approach a small object very closely, thus getting an image even larger than the original. Proximity gives extraordinary detail, so valuable in still life or commercial work.

Furthermore, the flexible bellows is indispensable in using adjustments such as the swing back and rising front. Because of the sturdy support of a tripod, and the substantial construction of a view camera, more adjustments can be used than with the average folding hand apparatus.

The importance of a two-way swing back cannot be overemphasized. Objects in different focal planes can be swung into focus without closing the lens down, thus making for more speed. The picture "Theoline," Figure 9, could not have been photographed with anything but a view camera with swinging adjustments. The reasons are:

1. A wide angle lens was needed to include the height of the buildings and masts.
2. The depth of field required with the sails of the vessel and the skyscrapers in the background was considerable; hence, closing the lens down would have been necessary unless all available swings, sidewise and vertical could be used. Yet the lens could not be closed down too far because the boat was moving up and down and a snapshot was necessary to stop its motion.



8. The addition of an ordinary but secondary object to help the photograph pictorially is here illustrated with the telephone pole slightly out of focus. The exact relation of sharp and unsharp portions is seen on the ground glass of the View Camera. Berenice Abbott photo.

Likewise, the photograph, "Department of Docks and Police Station" (Fig. 12), would be impossible without a flexible view camera. Again, a wide angle lens and rising front had to be used to encompass the center of interest, the old-fashioned but characteristic piece of American architecture, with sharpest detail. The postcard stand was included to lend the atmosphere of the locality, The Battery, New York City. By means of both lateral and vertical swings, both front and back, it was put in sufficient focus in relation to the principal subject. An additional difficulty was that the postcard stand was very near the camera. Finally the walking figures were "anticipated" to lend human interest and to solve the problem of composition of breaking up an otherwise empty space. An exposure of 1/25 second was possible with the Crown View Camera by using a slow wide angle lens, getting a wide depth of field and minute detail in the building, and stopping the action of moving figures.

Uses Of Swing Front

The swing front on a view camera can be used together with the swing back or in place of the swing back. The use of the front swing causes less distortion than when the back is swung. It acts as an additional rising front in extreme cases. If the camera is tilted upward and the back swung to make the vertical lines straight, the front can be tipped to be parallel with the back. Thus the lens need not be shut down to an excessively tiny aperture, and depth of focus is gained.

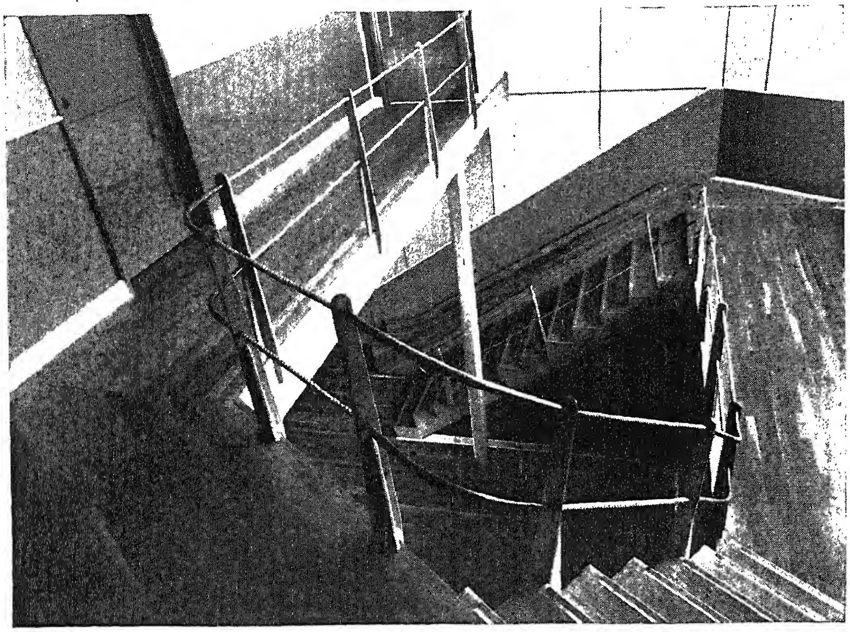
If the front of the camera is raised very high, illumination decreases in the upper corners of the ground glass. By tipping the front slightly, even distribution of light is obtained with scarcely any distortion.

Crown View Camera

The 4 x 5 Crown View Camera, for those who wish to combine the view camera's advantages with lightness and easy transportability, has special features. In addition, the 4 x 5 Crown View may be equipped with 4 x 5 and 3¼ x 4¼ interchangeable Graflex and Speed Graphic backs, which permit the photographer to use film and plate attachments from these cameras if he already has this equipment. If one is planning to branch out into a wide variety of photographic fields, he can widen the scope of his equipment by later purchasing the action type of camera, such as Graflex or Speed Graphic, with which lenses, film pack adapters, and reducing backs may be interchanged.

The change-over from horizontal to vertical pictures in the Crown View Camera is accomplished very easily . . . without disturbing the camera or any of its adjustments. The removable back, which is secured in position by means of four pins in as many spring-catches, is simply lifted out and placed back in the desired horizontal or vertical position. This arrangement accounts for

9. **THEOLINE,** New York. In this case the front lens mount of the View Camera was tilted to get all-over focus with a diaphragm opening of f:11. As the boat was rising and lowering on the water it was necessary to snap the shutter at the correct moment to obtain this composition. Berenice Abbott Photo.



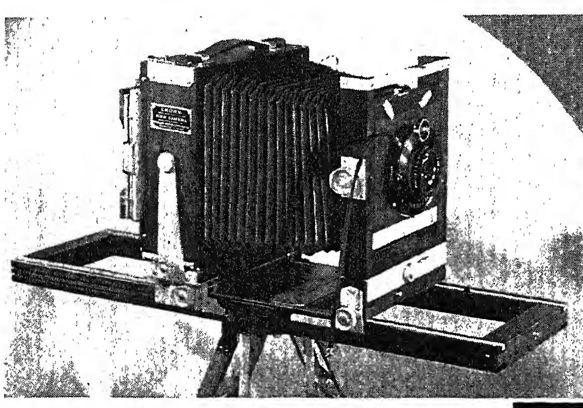
10. NORTH COUNTRY SCHOOL, Lake Placid, New York. Central stairway and children's slide in the main school building. The Crown View Camera, equipped with a wide angle lens, covered the full area at very close quarters. In this picture the ground glass was extremely essential in order to determine the exact composition and to avoid cutting off the wrong part of the picture. Berenice Abbott Photo.

the Crown View Camera being square: both its frame and its bellows.

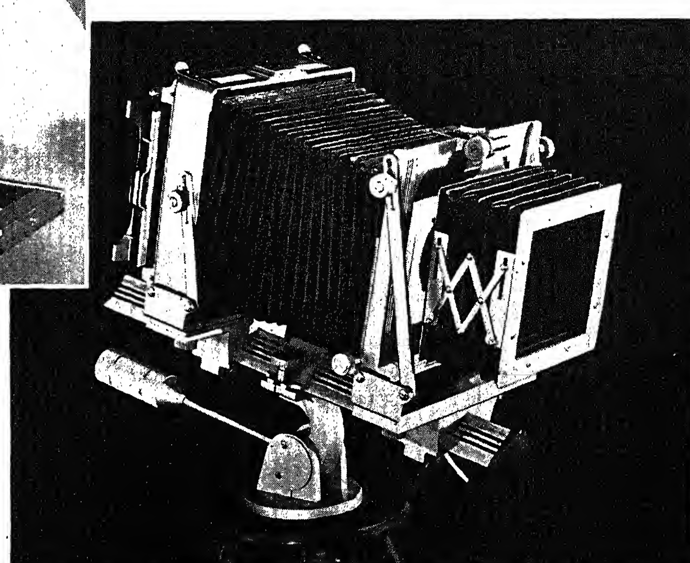
Lensboards are interchangeable on the 4 x 5 Crown View camera, allowing the use of any size lens whose flange will fit the board. The bellows, with extension section, can be racked out to a length of 19 inches, so that large images can be obtained with long focal length lenses. With short focal length lenses, direct magnification is possible. This feature is admirable for copying and close-ups.

The Crown View Camera has the advantage of focusing by means of moving the front of the camera as well as the back of the camera. Focusing the image with the back is very convenient where there is a long extension of the bellows which would make the front focusing awkward and hard to reach. Likewise, when a close-up of any object is being made, it is much easier to use the back focus than it is to use the front.

Equipment needed with the view camera includes: A sturdy tripod, which can be extended at least to eye level, preferably higher; a carrying case; a black focusing cloth, a good lens, preferably several; a sunshade to fit each lens, a half dozen film or plate holders, or more; filters, usually



11. (*left*) THE 4x5 CROWN VIEW CAMERA showing the double extension bellows rack in position and the camera ready for use.



11. (*right*) THE 4x5 ALL METAL GRAPHIC VIEW CAMERA—ready for action, shown with its accessory Accordion-Type Lens-Shade. The Camera, mounted upon its inverted "V" aluminum alloy bed and the flexible revolving and tilting tripod head base can quickly and easily be fixed in almost any desired position.

Wratten K1, K2, and G; a small carpenter's spirit level; an exposure meter.

The customary procedure is to use sheet film in holders. Sheet film has a stiffer celluloid base. There is less danger of the sheet film buckling than of the thinner film pack film, especially true when larger-sized film than 4 x 5 inches is used. The photographer can obtain a much greater variety of film emulsions for specialized purposes in sheet film. He has greater control in development, as he can if necessary develop single films with more controlled density, developing to different degrees of contrast.

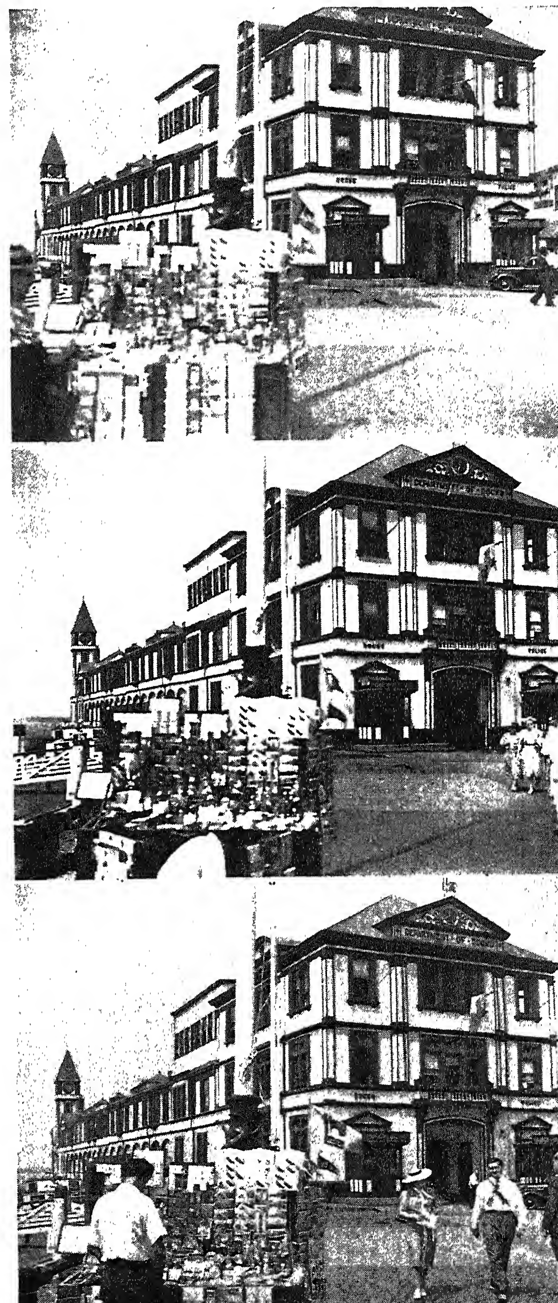
When beginning work with a view camera, first of all become thoroughly familiar with one lens. The lens should be of a focal length equal to the diagonal of the film used, i.e., the diagonal of 4 x 5 film is the square root of the sum of the squares of the sides. The equation works out this way: 4^2 plus 5^2 equals 41, and the square root of 41 lies between 6 and 7. Therefore, a lens with a focal length from 6 to 7 inches is indicated. Thus a *normal* lens for the 4 x 5 Crown View Camera would be the 164mm (6 7/16 inch) Bausch & Lomb Tessar f/4.5 in Betax shutter mount. However equally popular are lenses of other focal lengths, such as the 127mm (5 inch) Kodak Ektar f/4.7 in Supermatic Shutter with Press-Focus Button or the 203mm (8 inch) Kodak Anastigmat f/7.7 in like Supermatic Shutter mount. If finances permit, it is an excellent idea to equip the camera with any one of the Bausch & Lomb Convertible Protars, which are available in Betax shutter mounts in a variety of focal lengths: 131mm (5⅛ inch—Single element having a focal length of 9 inches), 146mm (5¾ inches—Single elements having focal lengths of 11⅜ inches and 9 inches respectively) or the 165mm (6½ inch—Single elements having a focal length of 11⅜ inches). A choice of Wide-Angle and Telephoto lenses is also available for the Crown View or the Graphic View Cameras. The value of owning a battery of lenses is that they make it possible to obtain images of different sizes and perspectives from the same camera position.

Uses

The view camera is essential for all work in which detail, definition, texture, faithful reproduction of the physical qualities of materials are required. Portraits, architectural subjects, copying, commercial work, scientific subjects, general view, are good view camera subjects.

Naturally these fields overlap. It is not exact to say that in all cases the view camera is better. For example, certain types of subjects such as very small objects (postage stamps, insects, etc.) are copied equally well with a miniature camera. Generally, fashion work can best be done with a view camera. Yet many fashion pictures are taken outdoors with a Speed Graphic.

The view camera is best adapted to architectural and interior work because the swinging and tilting back and the rising and shifting front permit flexibility of operation, they can be used to correct unwanted distortion or, again, to create the distortions sometimes desired for artistic effect. The slide front, such as the Crown View has, is indispensable when photographing from awkward positions, an interior from a crowded corner, or for any view where the camera may be forced into very limited space such as a window corner or doorway. It is likewise useful to eliminate reflections from an oil painting or a shiny surface. The back has a horizontal swing and a tilt of as much as 12 degrees from center in the

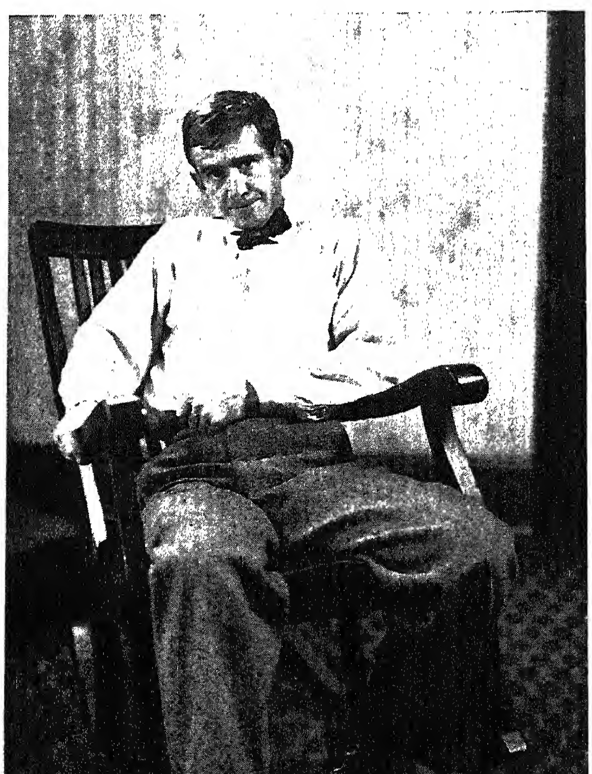


12. **DEPARTMENT OF DOCKS.** Three views to show use of various View Camera adjustments. (*top photo*) Note top of building cut off and newsstand out of focus. (*middle photo*) taken after adjusting rising front to include building roof. (*bottom photo*) shows foreground in focus and creates finished picture after using vertical and horizontal swing on back and rising front of camera. All exposures at f/11, 1/50 second. Berenice Abbott Photos.

case of a Crown View, while the front has a rise of one inch and a fall of 13/16 of an inch from center, with a lateral shift of 1 13/16 of an inch from center. Film pack adapters and cut film magazines may be used with this camera.

In photographing architectural subjects, exteriors and interiors, where definition is essential to suggest materials, such as brick, stone, velvet, textiles, and where it is also essential to represent the vertical planes of buildings and rooms in true parallel lines, the view camera is the most satisfactory. The spirit level is helpful to make the ground glass parallel with the plane of the building or room. Vertical and horizontal lines, drawn with a wax pencil on the ground glass can serve as guide lines to make the planes of the building parallel with the sides of the focusing screen. For architectural work, the rising front on a camera is indispensable, not only to include more height but also to eliminate undesirable foreground.

The swing back makes it possible to compensate for the distortion of verticals involved in tilting the camera to take in height. For architectural subjects, perspective requires a flexible bellows extension to permit the use of long or short focal length lenses. For all these requirements, the view camera is most suitable.



13. GILBERT WILSON, mural painter. Shows effective use of the View Camera for typical candid portraits. Berenice Abbott Photo.

Copying

For general copying work, no camera is as efficient as a view camera. In this field, squareness, rigidity, good-sized images that give exact rendering of detail are best obtained with this basic camera. This work is usually done close to the object and a long bellows is necessary, with the back focus facility. Direct magnification can be obtained with a short focal length lens. For critical copy work, the image can be measured or examined under magnification on the ground glass.

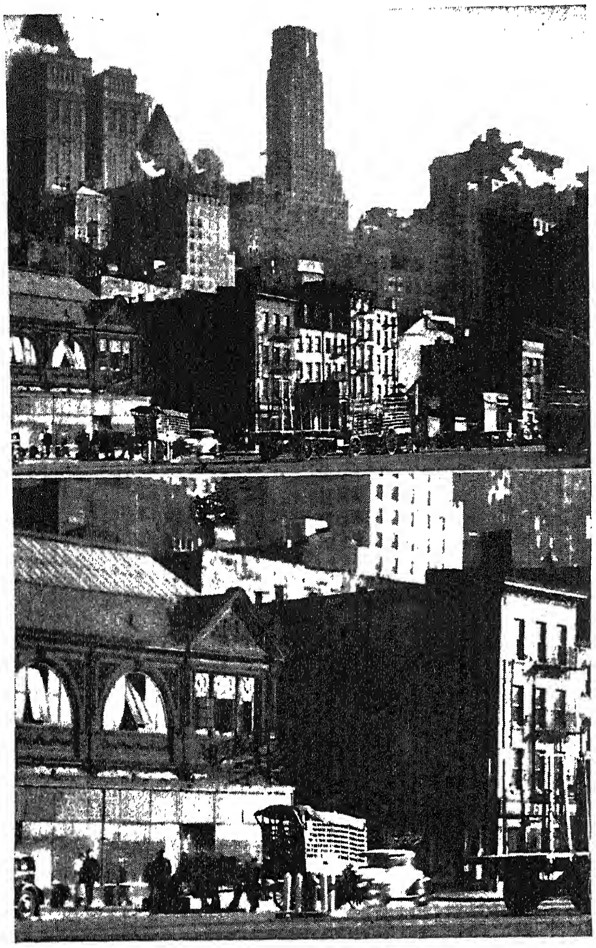
Portraits

Although the whole world makes portraits with any and all cameras, I believe that many of the best portraits are made with a view camera. Here, too, careful planning and exact considerations are necessary. Excluding for the moment the quality more important than all others in portraiture, namely spontaneity of expression and character, there are the "mechanical" and technical features. For superior work we aim for a combination of essence or content, skillfully executed, plus the "technique" necessary to carry this out.

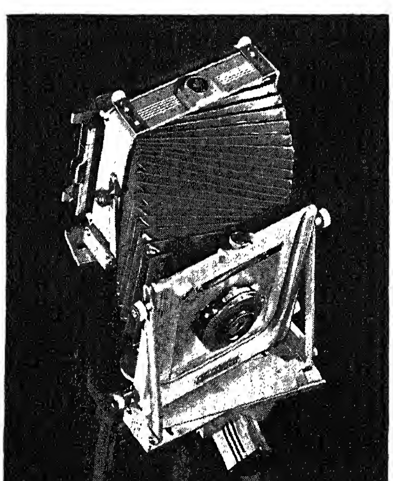
In serious portraiture, before we come to the candid quality of expression, we approach the task with the camera placed firmly on a tripod. The height of the camera must be considered to bring out the features of the sitter to best advantage . . . the distance from the sitter must be gauged for the best likeness, via perspective; the sitter's relation to the background must be decided upon; the important feature of lighting must be arranged. Now how is all this to be accurately determined if not visually on the ground glass itself? Once all this is settled and the figure is focused and arranged at least to the extent of the pose, the slide is withdrawn from the film holder and the operator is now ready to add that last minute spark of life . . . expression . . . which is due, not to any camera in the world, but to the photographer's creative ability to extract that spark, hook or crook, from the wary sitter under difficult conditions. No portrait is a good one unless it is "candid," spontaneous, natural, characteristic.

Of all fields in photography, the most abused and least understood is portraiture. The worst kind of portrait is a "photographic" one where the sitter appears in the least way camera-conscious. Paradoxically speaking, I think in the majority of cases this quality of spontaneity is as well captured with a view camera as it is with any other camera, with the additional advantage of quality, obtained by careful focusing and rigid control of light and tone values. All photographs worth the paper they are printed on are documents first of all. So is a portrait a document of the person. The face, hair, texture and type of clothes likewise tell the story. With the long bellows that the Crown View or other view cameras have, a long focal length lens, so appropriate for portraiture, can be used so that correct likeness is obtained without ap-

14. PORTRAIT . . . Another example of candid portrait photography with a View Camera. Exposure, ½ second at f:6, Medium Pan film. Two lights for illumination; one spot on left, and a front high diffusing flood. Berenice Abbott photo.



15. Motion or slightly out of focus section in the large sharper View Camera pictures is not disturbing. However, in the very small camera negative, enlargements may distract from the picture interest. The bottom picture shows enlargement from lower left corner of the upper view.



16. **GRAPHIC VIEW CAMERA** showing remarkable flexibility of both front and back, capable of almost unlimited possibilities of relating lens and film.

proaching the sitter too closely and involving distortion, hence very subtle but definite unlikeness.

Here too, the swing back is required. For spontaneous expression, a short exposure is imperative. By swinging the back or front a trifle, that blurred shoulder or hand can be brought into focus without closing the lens down and slowing the exposure.

So with general views as well . . . careful focusing, depth of field and perspective, exclusion and inclusion, image sizes are superbly realized with the sturdy view. Action can be anticipated or planted to some degree where a reasonable amount of motion is necessary and the speed of film permits. Ninety-four per cent of the photographs in my *Changing New York* book were made with a view camera.

Things The View Camera Cannot Do

The photographer cannot set up a big camera on a tripod in the middle of a street, whether that street be Times Square or Main Street in a thousand American cities. With a view camera he cannot take pictures from a moving train, bus, auto, or even bicycle. He cannot take sport pictures or close-up action shots, except in unusual circumstances. He cannot go into a normally lighted interior and take shots of people engaged in ordinary activity. The view camera, whether $3\frac{1}{4} \times 4\frac{1}{4}$, 4 x 5, 5 x 7, 8 x 10, or 11 x 14, is not candid in the sense that the camera can be hidden in the clothing, enabling its operator to take pictures without the knowledge of his sitters. Nevertheless, spontaneous and revealing pictures can be taken with the view camera.

One may fail to get a picture because the view camera cannot be snapped with the same speed and ease as a Brownie camera. Spot news pictures are not the meat of the view camera. Yet the fact that the photographer must prepare himself and his equipment to make a photograph, to a great extent rules out accident as a factor in his success or failure. If he has gone to the trouble of selecting a point of view, setting up his camera on its tripod, focusing, taking an exposure reading, setting the shutter, inserting the film holder, withdrawing the slide, it cannot be claimed the photographer just happened to click the shutter at the right moment. For example, it was no lucky break that I photographed the steeple of St. Mark's-on-the-Bouwerie festooned with scrolls of skywriting. I saw the plane, chose the vantage point, set up the camera and got ready; then waited half an hour until the writing came around in the right relation to the church steeple. The only bit of luck was that the plane kept on writing and that the sun stayed out!

Now for working mechanics. First read the manufacturer's directions. Familiarize yourself thoroughly with the parts of the view camera and practice making adjustments before actually taking a photograph.

Chronology Of Taking A Picture

1. Choose a subject outdoors in good light.
2. Study it to determine the best angle of view.
3. Set up the tripod and fasten the camera securely.
4. Determine the correct height.
5. Adjust the angle of view as the subject is studied in the ground glass.
6. Manipulate the position of the camera for the best perspective.
7. When the picture is composed in the ground glass, level off the camera with the spirit level, or guide the vertical lines of buildings along the straight edge of the ground glass.
8. Take exposure meter reading.
9. Adjust the lens for aperture and the shutter for time.
10. Insert the film holder in the camera.
11. Withdraw the slide from the holder.
12. Click the shutter, preferably with cable release to prevent jar.
13. Replace the slide, making sure it is so placed as to indicate that the film has been exposed; that is, with the black edge out.
14. Remove the film holder from the camera.
15. The film is now ready to develop.

17. James Joyce. Here is an excellent View Camera portrait by Berenice Abbott. Note the complete naturalness of the subject without the typical soft detail or even the very hard sharp contrast which is often seen in some portraits.

1. This picture made in Puerto Rico proves again the extent advertisers will go to in order to get realism into their ads. As the picture had to be made in mid-winter, the advertiser felt that a long trip was necessary to present his creations correctly when the advertisements were released in the summer. A bathing suit picture for Socony Knitting Mills. Snug fit . . . freedom of body and graceful action were the keynote. Exposure, 1/440 second, f/8, G (No. 15) filter, Fast Pan film.

ILLUSTRATIVE AND ADVERTISING PHOTOGRAPHY

JOHN F. O'REILLY

"Done any flying? Been up in a balloon? D'y'ever ride horseback? Able to use a typewriter? Can you write a telegram, I mean, pack a story in a dozen words? How about time-tables? Can you read the damn things and be sure you'll catch the train you start for? How fast can you pack and get out o' town?"

I wasn't planning to flee the country a hop ahead of the G-men; I didn't want to be a Hollywood stunt man; I had no desire to be a train dispatcher, a transport pilot, a reporter or an international spy; I simply wanted a job as a news photographer, yet the editor of one of the country's leading newspapers fired that volley of questions at me. Surprised and a bit indignant, I gave clipped and resentful answers. At any rate, I got the job, and before long I realized there was reason for every one of these questions and a dozen others. The news photographer must be a reporter, a photographer, a dramatist, and as loosely home-tied as a soldier of fortune.

A trifle dazed, I left the editor. I wondered why he had not questioned me about my background in photography. I learned later that this information had already been gathered and appraised. He knew I could take pictures; he wondered could I sense a story, sweat to get it, and then, tell it with a camera, succinctly and compactly.

During my time as a news photographer I labored hard to cultivate and improve my sense of story-value and to master the knack of the camera method of story-telling. I learned, too, the importance of equipment and the necessity of keeping it in perfect condition. As a commercial photographer, I have not had to unlearn these lessons. They are basic and essential.

I have, however, found it necessary to depend less on luck. For luck, though it looms large in the news field, plays a very minor role in the advertising game. The advertising photographer must be more an artist. He creates his stories, he doesn't chase them. And, he must plan those stories, or pictures, accurately and economically — there is no room for second guesses, no room for retake after careless retake. He must hit the button every time, for time and money like great vultures soar hungrily over every job and the photographer works forever in their brooding shadow. Though he may hope for a lucky shot, he cannot count on one.

The advertising photographer, too, unless he is a specialist — and there are comparatively few of them — must be more a jack-of-all-trades than his brother on a news job. Every assignment presents new difficulties, new and intricate problems which must be resolved quickly. Though I did not, as I have said, learn photography in the news game, I did learn much that has been invaluable in my present work and I am convinced that the experience and the power of expression which newspaper work gives are priceless as a background. Life is best illustrated by one who knows life. Each day brings to the news photographer a new assignment, sometimes exciting, sometimes dull as dishwater — sob stories, snarling crooks, heart throbs, the brittle glamour of society affairs, disaster and comedy; all is grist for the camera's grinding. Day after day the camera is trained on shifting, changing, many-faceted life. All these things have helped me as an illustrator and today I yet look to the daily newspapers for my lessons in drama, I still study my well-thumbed texts.

A Tense News Assignment

A page torn from my newspaper days may serve to show what profit I have drawn from this period.

At Miami covering routine winter news, I received a wire, "COVER LOCKHART SPEED TRIALS IN DAYTONA BEACH, SIGNED CITY DESK." I was enroute to Daytona before the kid was back at the telegraph office. I knew the way my editor worked, knew that he had checked train times and would wire any further instructions to the train itself. I wasn't wrong. My next wire was "USE TRAIN OR PLANE FOR BEAT ACCORDING TO VALUE OF STORY, SIGNED CITY DESK." On the train, I checked times of every train and plane out of Daytona to my distribution office. Arriving, I holed in at a hotel, found there was nothing doing at the beach, went out to the airport and made a dicker with a pilot for transportation in case of need. Next morning, I went to the beach, struck up an acquaintance with the mechanics, hobnobbed with Lockhart himself, made long shots and closeups of car and driver from every conceivable angle, keeping in mind always reproduction difficulties and layout possibilities. Back at the hotel, I shipped these photographs to the office, then sat down to wait for a broken record or a broken neck.

All illustrations by John F. O'Reilly

It was a long wait. Two weeks to be exact. Morning after morning, I trekked to the beach. Then, on a foggy morning, a stiff northeast wind blowing, I found Lockhart giving his engine the final delicate adjustments. Oblivious of the group about him he fussed over his motor, muttering every now and then, "If I can get this motor singing, I'll let her go!" Finally satisfied, he announced his readiness for the run. No one doubted his courage, his iron nerves, or his complete faith in his car, but everyone, mechanic and reporter and expert, tried to dissuade him. No man, they felt, could with such poor visibility, lift a car up to a two-hundred-mile-an-hour speed in safety. I left them still arguing with him and, though convinced he would not make the run I held to my practice of staying with an assignment until I saw it through, went back along the beach to the timer's stand and read a magazine to kill time. The deep tremendous roar of a powerful motor far down the beach galvanized us all to tense attention. A white flash, fast as light, sped out of the cool gloom. A woman beside me gasped, "My God!"

To this day, those who saw that run argue the manner in which the accident happened. I'll stick by the testimony of my trained eye.

The car was running along the firmest part of the beach — close, dangerously close to the surf. An innocent tiny wave washing gently a little further up the beach than its fellows licked at his right front tire. Torn from its course as by the hand of a giant, the streamlined car leaped towards the ocean, catapulted across two waves and landed right side up with Lockhart's head almost submerged.

As one man the crowd ran for the ocean. A group of us, up to our necks and clinging shoulder to shoulder formed a circle around car and driver trying to shield Lockhart from the breaking surf. One man, hauling a tow rope, ran down the beach, through the sea and tied it to the wrecked car, then all lay hold on the rope and dragged the car out. As soon as the car was safely beached and Lockhart released, I raced, with dripping clothes, to the railroad station, shipped my undeveloped negatives to Atlanta to be wired across the country, then, guarding against any possible loss in transit to Atlanta I shipped another batch direct to New York. To the nearest telephone then, and talked with the City Desk advising them to expect wire photos; then to the hospital, to find that Lockhart had suffered only a broken wrist but, because of shock, would be unable to see anyone for a couple of days; back to the hotel, then for a bath and a drink.

Later that night, while I was cleaning salt water from my Speed Graphic, I got the laconic wire, "PROCEED TO ASHEVILLE, NORTH CAROLINA, SIGNED CITY DESK."

I've told this story not as a story but to point out those elements of a routine news job which tie in so closely with my work today in the field of advertising photography. Illustrator as well as news photographer must be able to arrange speedy transportation, be sure of his equipment, plan layouts, have unlimited patience, photograph under stress and photograph for best possible reproduction, squeeze out of a situation every drop of drama, then move on casually to another job, another problem, another day's work.

I came into the newspaper game fresh from a stiff apprenticeship in the commercial and illustration studio of Edwin Levick. In passing, I might, perhaps with profit, remark that this apprentice stage of the game is too little appreciated. Too many, nowadays, who can rustle up enough money to buy a camera and read its accompanying booklet of directions set up immediately as experts and rove the town intent on trick and angle and complicated shots. Too many photographers of today are convinced that they can run and leap before they learn to walk. They do not seem to realize that there is a necessary and heartbreaking novitiate to be gone through, an apprenticeship during which elementary facts are to be mastered, technique acquired, composition appreciated and light studied. These things can only be learned the hard way, by constant and diligent practice. Trick and complicated shots are no more than the icing, it's the cake that matters; and, in photography, fundamentals count.

Early Graphic Equipment

The camera I used during those beginning years was an 8 x 10 and a 6½ x 8½ plate size Speed Graphic. Today a 2¼ x 3¼ is accepted for fine work. No one, however, in those days believed in the small camera, and for good reasons. Improvements, however, in the manufacture of sensitized emulsions have given the photographer a finer medium and he now can work with a smaller camera.

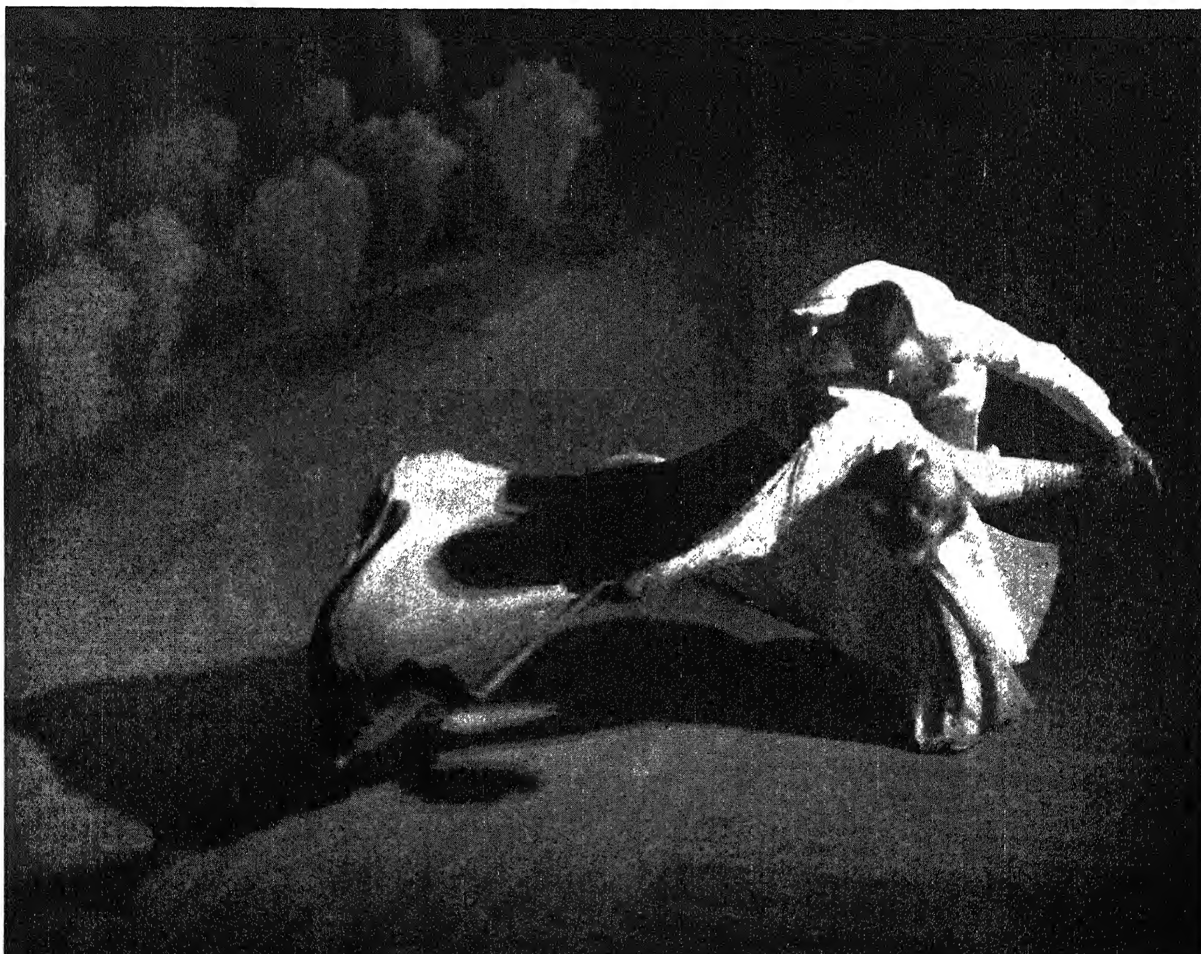
The day I first used a 5 x 7 on assignment I felt that I was startling the world. Edwin Levick believed in the Speed Graphic and proved again and again that quick thinking in both commercial and newspaper work is best served by this type of camera.

The Speed Graphic is not pocket-size, it's true, but always, as I soon learned, dependable. Moreover, with a camera which was not nine-tenths machinery, I was able to devote more time to composition, lighting and subject matter. Levick's first advice to me was, "Go out and shoot! Shoot, shoot, shoot until you're tired of shooting, shoot until you begin to learn what you're trying to achieve!" Day after day when my routine assignment work was completed, I went out on my own to "cover" the town. The more problems I found, the more quirks and intricacies of lighting I encountered, the better I liked it. I took thousands of pictures and studied results in each one, then tried to correct my faults until the

time finally came when I was almost certain of the finished picture before I released the shutter. I began to think first of the picture, then the camera. The camera and I became a unit, or as a prominent photographer once said, "The camera became a sixth sense."

This far, I have sketched my own background, not egotistically but rather that I myself might better analyze and understand my own technique and my own approach to my work. It is difficult, well-nigh impossible, within the narrow precincts of a single chapter, to cover this vast photographic field. During the years that we, Gray-O'Reilly, have been in business, we have seen so many phases of the game, run into so many and such complex problems, have discovered so many new angles, have adapted ourselves to so many new developments and trends, that we firmly believe that only by the publication of a veteran photographer's day-by-day business diary can justice be done to the subject of advertising photography.

It is difficult, likewise, to lay down a set of hard and fast rules. The field is large, the problems myriad, and method so diversified that there can be no set procedure. No two photographers work alike any more than do two painters. Given the same subject, each interprets it for himself and results are clearly dissimilar. There are, however, some fundamentals on which all good work must depend. We are interested here in outlining some of these common, basic principles and in showing what part they have played in our own work. Analysis of the pictures in this chapter will show why these pictures were taken, how they were made and, as far as possible, what result they actually achieved.



2. THE DANCERS. This type of picture must be outguessed with a camera to get the full sweep and design of the composition. All dancers follow a certain tempo while performing. It is necessary to keep this tempo in mind . . . don't attempt to shoot on the first turn or the second. Time the movement in your mind so that you shoot on the third turn to capture the picture you have already seen. This picture was made for *Stage* Magazine during the latter part of 1934. It was one of the forerunners of candid stage shots. This action photograph was admired by many people and we received many requests for reprints. Made with a small Graflex. 1/295 second, f:1.9 lens at the widest aperture, Fast Pan film.

3. DANCERS for *YOU Magazine*. A 5,000-watt light placed on the left as general light theme. Large cardboard cutout to the side of light gives shadow on the background and increases depth of picture. 2,000-watt spot on right side was slightly back. Two 1500-watt floods at camera position to illuminate shadows. Made with a 4 x 5 Speed Graphic, 1/1000 second, f/3.5, Super XX Pan Film.

Importance of Composition and Direction

Composition and the proper placing and direction of models constitute eighty per cent of the effectiveness of any picture. In planning a picture and in my preliminary survey, I am constantly conscious of background, of the planes and circles and pleasing lines which will best set off my models, continually I am imagining how people will look against the planned background. For example, I have a shipboard setting, a setting that is always interesting in itself; I must, consequently, plan placing the models in such positions that they will dominate and not be overshadowed by their background. Life preservers, funnels, deck-chairs and all the colorful trappings of shipboard are so fascinating in themselves that they can easily steal a picture. It's abominably easy for a shipboard photograph to become a catalog of ship's fittings rather than an arrestingly dramatic picture of life aboard ship. Background is important, but it is important only as a setting for the model or the product to be advertised.

The proper direction of models, too, is tremendously important. Their *every* position and movement must be planned. The photographer must have his mind pretty well made up before he goes on the set, he must have a mental picture of his final photograph before he snaps a shutter. He must know exactly what he wants his models or model to do. Thus prepared, he is ready to get a coordinated, properly balanced and dramatically realistic picture.

Models must be directed, they must be told what to do. You never hear of a successful play director telling his actors just to keep moving or running about the stage. He assigns specific action to each character. This the director cannot do unless he knows what he wishes to achieve. The photographer must be equally conscious of his objective.

It is presumed that a good photographer has outgrown "Photo School" methods. He cannot tell the model, "O. K., all set, now do something!" He may, by this method, get a miraculously good shot. The chances are, though, that he will get only mediocre results. And that is all he deserves. Proper direction of models entails thought and planning.

The model or models will cooperate if they sense that the photographer knows clearly what he wants. They will be stiff and inflexible if they suspect aimlessness. They withhold confidence from the man who does not know exactly what he wants and the upshot of it is that they try to get the upper hand and pose the picture as they wish it. The picture result, as a rule, is a wash-out.

Personally, I have tried always to win the confidence of those with whom I am going to work. I go out of my way to explain and convince them that they are not lay figures, soulless mannikins. I try to show them their importance and how completely I depend on them for the realization of my picture. I try to know them, try to make them enter into, understand, and appreciate what effect I am striving to achieve. In nine cases out of ten I get cooperation. And, without one hundred per cent cooperation, the best results cannot be secured.

Having arranged the people against my set and after they have fallen into their most advantageous positions, at that instant, I make the picture. When the release button is pressed and my film is exposed, the picture I have caught is impressed on my mind. From there on I can start improving — a change of a model's expression, a dress rearrangement, an easier and more gracefully natural gesture. It is just like correcting typewritten copy. Once ideas are on paper they can be reshaped, corrected and improved. When my first shot is taken I keep on taking photographs in fairly quick succession.

More About Models

In selecting models for special photographic jobs, I usually run through agency photographs and pick out the most likely. An interview later is essential. A model nowadays must have more than a perfect figure, more than a pretty face. She must have smart carriage, ability

to wear clothes, charm of manner and intelligence. We look for natural models today, not the lavishly and cloyingly beautiful orchids of yesteryear. After all, we have to keep in mind the audience to which the advertiser is making his appeal. Today a man wants a girl to whom he can talk, a partner for bridge, dances and the golf course, one who can take part in a business conversation. To this man in the street, the advertiser is directing his sales appeal. The photographer must produce the photograph to intrigue and interest his audience.

The trouble, and this is of course quite by the way, with women models is that ninety per cent of them pose usually for fashion photographs. Then, when it is necessary to use them for any other types of illustrative photography, the photographer must be constantly on his guard to avoid stylized fashion poses. Stylized fashion photos are all right in their place. They can, however, spoil an illustration, rob it of life and reality.

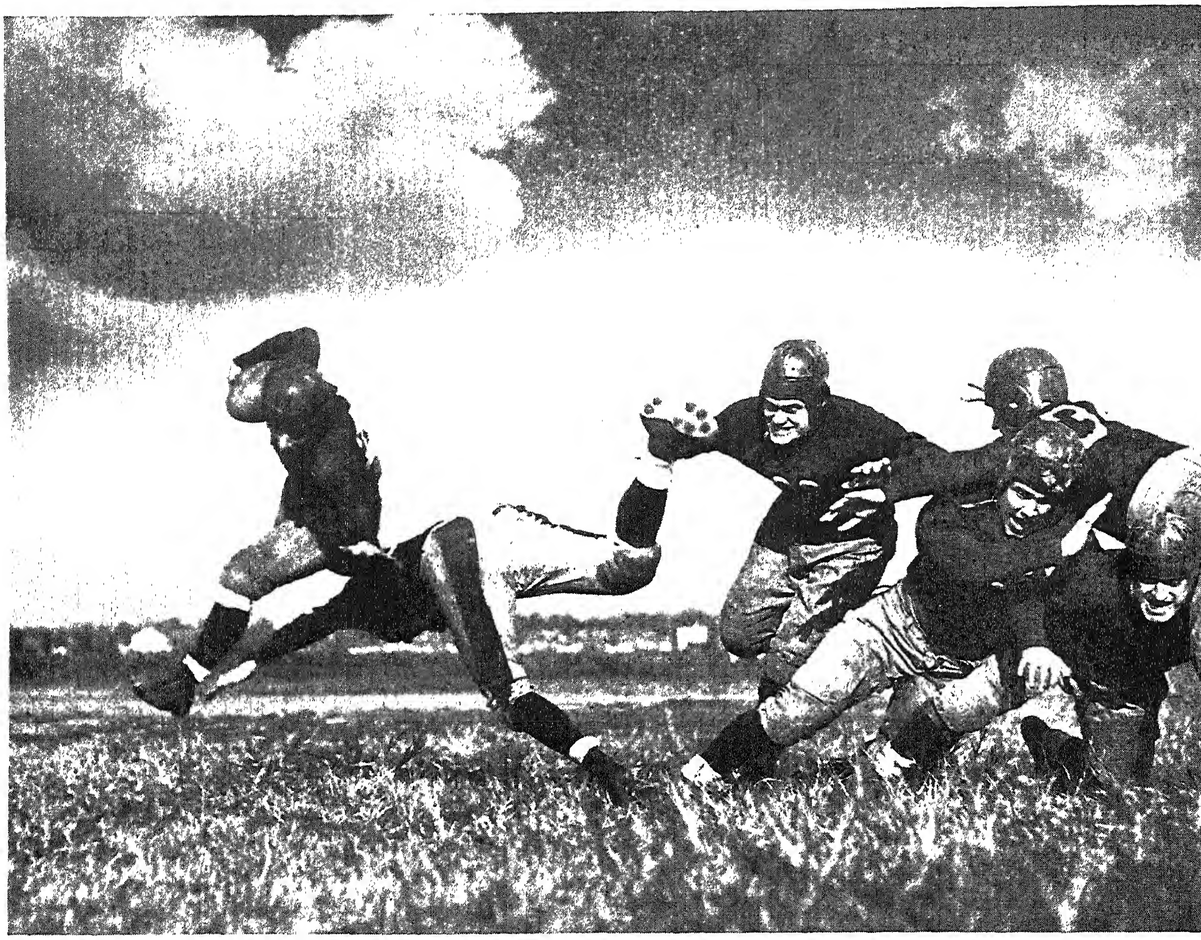
Another point. Many a model does not know how to walk properly. Left to themselves they will carry into a picture awkward coordinations which will ruin it.

This accentuates the necessity of intelligent direction.

Choosing Models

Casting the right people for an "ad" is a job in itself. The model must fit the part. The languid beauty of the society model, just dripping with glamour and luxurious ease, will be out of place in a *Good Housekeeping* ad when the advertiser wants to depict the average housewife who is tickled pink over the purchase of a new electric refrigerator, and the bustling housewife type will not boost bath salts or perfume sales in the sleek pages of *Vogue*. The model must be picked with an eye to the objective, and this calls for patient search.

4. DEAD END, for *STAGE* Magazine. I believe that this picture gives graphic proof of the necessity of proper exposure and careful development. Too short an exposure would have meant the loss of important detail in the shadows. Note the man in the shadows and the many other details which definitely complete this composition without being overilluminated. 1/10 second, f/3.5, 8¼ inch lens, Fast Pan film, developed in ABC Pyro formula, carbonate cut for the first 15 minutes, then added for 5 more minutes' development.



5. A football picture used during the football season as an attention-getter for Kessler Whiskey account by Legler-Warwick Agency. An entire semi-pro football team was hired and put through their paces. The end man was paid a bonus to put all he could into the action. Hours were spent getting them over the paid-picture stage to get realistic action. 1/800 second, f:5.6, K2 filter, Fast Pan film.

One of our "ads" called for pictures of touring Americans crossing the border between Greece and Jugoslavia. While the set was building on location, we interviewed more Greeks than ever I thought existed in this part of the world. Patient search was rewarded. Every time the picture has been shown or published the idea we sought to put across was grasped. We captured an authentic bit of the old world although we shot it in Rockland Co.

Another time, we had to show a crowd of laborers lining up at the paymaster's window. Jim Gray and I spent a whole day rambling Sixth Avenue looking for true-to-life types. One old buzzard we approached asked how much he would be paid. When told he would get the regular model fee, $5.00 for an hour and a half, he shook his head. "Nope, nothin' doin'! buddy! I ain't posin' in the nude for no lousy five bucks! SCRAM!" After explanation, he agreed to pose, and paid off in easy money, he asked, "Say, bo, how long's this racket been going on?" That picture, too, carried the punch of *authentic* life.

There is a great deal in common between Hollywood and the office of the present day illustrator. After the models have been sought and chosen, the illustrator, besides making the photograph, is expected to design sets, handling any period from prehistoric or Biblical times down to the present, cast his people, act as transportation manager, know the newest in smart clothing for both men and women, direct the picture, understand engraving, make-up of "ad" space; he must know how a hangover looks and feels, just how bad a sick person should appear without scaring the reader; he has to be able to simulate a laugh, a snicker, a chuckle, and, on top of all this, he must be a make-up man. A half dozen or dozen people may go into a picture, a whole staff of technicians may have labored on the making of the set, but the illustrator, the photographer, is ultimately responsible. If the picture is to be successful it must be well planned and the model capably directed. The advertising illustrator of today is more than just a photographer: he must be a jack-of-all-trades.

6. **COVER DESIGN,** for Spring, made only for appeal from the lovely-girl angle. Used on "Buyers' Guide" cover for Talon, Inc. 1/10 second, f:11, 2000-watt boom-spot overhead, 1500-watt diffused flood over camera to fill shadows and bring background up just enough so that lettering could be used without complete loss of flower theme, Fast Pan film.

Lighting

Before going into technical detail regarding some of the photographs which illustrate this chapter, I want to say a word about one of the major factors in advertising photography — some consider it the most important — namely, lighting. By lighting I do not necessarily mean studio lighting. For the handling of daylight is as important as studio lighting. We can't dismiss daylight by thinking or saying, "Well, daylight is daylight and that's that." Daylight is as truly an artistic medium as artificial lighting and poses as many and as difficult problems. And problems make photography exacting and exciting.

The sun is a landscape artist. Deftly it paints in shadow and highlights every field we traverse, every street we walk. The sun can teach us much, but, it can be treacherous too. It can, in its blaze, flatten details to invisibility, or in its soft, maudlin splendor blanket a scene or a person, destroying all tone value. We can learn much from the sun, and we can offset its treachery and rectify its unevenness by the careful and proper use of filters, lenses, timing, reflectors, and artificial outdoor lighting.

Photographic lighting is a variable that demands forethought and planning. There is a strong temptation to become stylized in its handling, and stylization entails a dulling of the creative faculty and a loss of that ready adaptability so necessary to the success of the commercial photographer.

In setting up lighting in our own studio, I always start from scratch. I place the model in position before any lights are brought on. I then study the face very carefully to determine the best type of lighting to be used. I light the model in my own mind first. Then, when I know just what lines and features to bring out, spot and floodlights are trained. The face is always correctly lighted first, then the rest of the body with supplementary spots.

I find that every model presents a new lighting problem. No two subjects can be given exactly the same type of lighting. And, though this fact entails for me a trifle more thought and work, it pays dividends in other ways, for the necessity of retouching is reduced to a minimum. I believe, of course, that a photographer should strain his efforts to avoid retouching. It is necessary at times but it can be avoided, indoors and out, by the use of proper reflectors or the careful use of the flash. It is better to capture the detail or expression we want on the negative itself rather than plan to have a retoucher compensate for a lack of knowledge or effort. Light, daylight or studio light, can be so handled that it is slave instead of master.

To avoid any stylizing of lighting effect, and the easy habit of using the same set-up from one job to another, I have found it worth while to strip all lights from the set and place them against the wall as soon as a job is done. It is the only way, I think, in which variety, which is so essential to continuous creative production, may be achieved.

Tripod *vs.* Free-hand Exposures

There is a great deal of latitude for discussion on this question of tripod and free-hand exposure. Habit and skill count for much. The tripod is, of course, essential when it is necessary to stop the lens down for long exposures of possibly 1/10 second or more; it is obviously essential, too, in all types of close work, whether indoors or out, where a wide angle lens is used. Though I habitually use the focal plane shutter on my Speed Graphic for all action exposures, I take the tripod along with me on every job, for the front Compur shutter, which was first used on the Speed Graphic as an auxiliary shutter, gets frequent and important play when using the synchroflash outfit, in any trick composition, and when a combination of short time exposure and flash is used.

In my work, and because of long habit, it seems easier and quicker to wind and release the focal plane shutter. I can get a better trigger squeeze on the focal plane shutter trigger than on the cable release of the front shutter.

In the final analysis, much of this discussion reduces to the method of holding the camera. A proper stance is essential. Its importance cannot be overemphasized. For, when the camera is hand-held, the person holding it substitutes for the tripod. This certainly means that the camera must be securely held with both hands at the moment when the shutter release is squeezed to make the exposure. To get a sharp negative the camera must be free of vibration or motion. When correct camera-holding position becomes a fixed habit, when hand and mind coordinate, more time is left for planning the photograph, and the photographer can work more rapidly and confidently. Camera-holding, like a good golfer's stance, club grasp and properly timed swing, must become second nature if satisfying results are sought.

Following Through An Assignment

There are really but two types of photographs: the planned picture and the lucky shot. The commercial photographer naturally runs into few accidental masterpieces, his bread and butter lies in the carefully planned picture. He works on assignment and schedule.

Perhaps the story of a typical assignment involving most of the elements in modern advertising photography will best illustrate this. I give it factually and simply.

A phone call comes from a client, in this particular case the advertising agency handling the account of a nationally advertised line of men's shoes. "We're planning a national campaign," you are told. "Can we get to-

7. WOMAN'S STYLE ANGLE . . . comparing to smart car tailoring. This picture was developed purely from the angle of composition and smartness. McManus, John and Adams, for Pontiac automobiles. 1/5 second, f:16, Portrait Pan film. Lighting overhead 2000-watt boom-spot for overall illumination, 2000-watt spot across doorway background, one diffused 1500-watt flood to fill shadows.

gether for discussion at four o'clock?" At that hour, the art director, account executive, and the photographer get together and start talking. The agency men present about a hundred possible picture situations illustrating shoes. They are gone over carefully, each one evaluated for picture possibilities and cost. Most agencies feeling that the photographer's interest in making a successful "ad" is one with their own give the illustrator considerable freedom. They want teamwork and, as a rule, they'll play along with the man who is practical as well as artistic. For instance, some one may suggest a transport plane setting. The photographic illustrator asks the size of reproduction and finds it will be one by two inches, then explains the time and cost element — an hour to the airport, at least an hour of shooting and model fees running well up to fifty dollars. The situation is scrapped by the agency because the same idea can be put across as well by shooting a train while on location making other pictures. The photographer's job is to know the cost of every prop or staging of every situation, so that possibilities may be O.K.'d or discarded before a penny is spent.

We have found it best to decide on one good punch situation, a hayride scene, for instance, as a good lead illustration, and leave minor situations wide open for choice when a suitable location is chosen.

The conference concluded, the photographer checks his necessary props — reading from my office record the shoe campaign called for a canoe, beach cabana, swing, diving board, pier, beach umbrella, a wet road — so I plan to carry along a hose in lieu of rain, a child's sailboat, golf bags, open car, hunting outfit, gun, blank shells, etc.; tennis equipment, picnic set-up, flowers, badminton set, piano, settee, easy chair, railroad station, horse and buggy, hay and a hay wagon, stone walls, English fences, and a brook. All this sounds, I know, like an Abercrombie & Fitch salesman's nightmare. The only place near the metropolitan area to offer opportunity for all these necessities is Connecticut. So, we plan to go to Connecticut.

Assignment Preparations

Then real work begins. Assistants collect props, and arrange hotel accommodations and transportation; cameras are readied, two Speed Graphics in this instance and a variety of lenses, for precious time and daylight are saved when assistants can prepare cameras and proper lenses while the photographer concentrates on shooting; filters are gone over with an eye to every possible lighting difficulty and a comparatively few selected, a K1; K2; G, 15; E, 23A; A, 25; and an F, 29; with these few it is possible to simplify illustrative work and produce special effects. For example, a K1 or K2 gives a sky reproduction in a soft, gray tone and the advertiser may use the space for copy or headline, or the red F, 29 will come in handy for extreme effects, or correction filters may be used to sharpen the contrast between a model's costume and a colored background.

Regular panatomic and fast pan films are packed, plus 60 film holders to cut down reloading time while shooting; synchroflash equipment, the single as well as the six-bulb type, are checked; extra batteries for flash equipment are included; and reflectors for outdoor work are set aside and a set of portable lights is added in case any last-minute shift calls for indoor work. All this equipment is carefully arranged with an eye to accessibility and order of use. Camera and equipment carry a heavy load of responsibility on an assignment like this, and perfect equipment and arrangement are the only solution for fast and successful work. Time presses and unnecessary delay makes the client's face grow longer with each passing hour.

This brings me back to an earlier thought. The photographer is paid for results. The less equipment fuss and delay there is, the better. The day of the long-haired artist dashing about, with a rapt and mystic look, in a wilderness of wires and lights is gone. The photographic art-buyer of the present, though he knows the necessity and value of equipment, really doesn't care if the illustrator makes a picture with an old derby so long as he gets results. Equipment fuss and artistic disorder no longer impress. The advertiser wants efficiency and results. He pays for results, and justly, and to them he is entitled.

Props, clothes, and equipment being in order; the agency representative, models, assistants, and photogra-

8. Advertisement showing how the photograph has been used.

9. One of a series of pictures featuring Spud cigarettes for Young and Rubicam account. The general idea of this series was to make pictures to illustrate the thought . . . keep cool throats despite dust, etc., etc. This illustration brought forth a problem of time and action, creating dust and at the same time having the feeling of a speeding automobile. First we had the car race down the lane, but found that we couldn't raise enough dust that would photograph. After innumerable tries, we found that if we raced the car and then applied the brakes suddenly the dust would be perfect. But then the models would be out of our layout area, which is the great god to all advertising photographers. These problems were solved by timing the car from a standing start in second gear to the time the brakes were applied. Then the models were timed until we found the proper starting point for them. The models were rehearsed and then we were finally ready for shooting. The car started approximately 100 feet away and the models about 30 feet. Exposure at 1/150 second which was not too fast to stop the action completely and lose the feeling of movement, f:11, K1 filter, Fast Pan film.

phers move to location. On arriving, clothes and shoes are arranged in order of shooting, outfits are assigned each model; cameras, lenses, filters, and reflectors are checked, cleaned and set up for use. Then, a rambling jaunt over the countryside for a final examination of locations and the writing of a shooting sequence by the agency men and photographer. A written sequence is important, for model fees, (this job called for six models) will run $150.00 a day and there's not time nor light enough in one day to allow for aimless jumping from location to location.

Using Various Lenses

The Speed Graphic was used throughout this assignment. It is an ideally flexible instrument, lenses are easily and quickly interchangeable and the exposure range is almost limitless. Three or four lenses were actually used, shift being made from lens to lens as the best picture advantage dictated. Usually it comes down to getting a good place for a comfortable camera-stance and a good size image on the film. In the 4 x 5 Speed Graphic, I used the 5¼, 8¼, and 14-inch lens. For safety's sake, though I found no use for them in this particular job, I carried along a 17-inch and a 28-inch lens, which I use normally only for sporting events when it is impossible for me to get down on the field or close to the ringside for closeup action shots. As a rule, I find the f:4.5 lens satisfactory; rarely is it necessary for me to use a faster lens speed, though I do carry an f:1.9 lens for extreme emergencies.

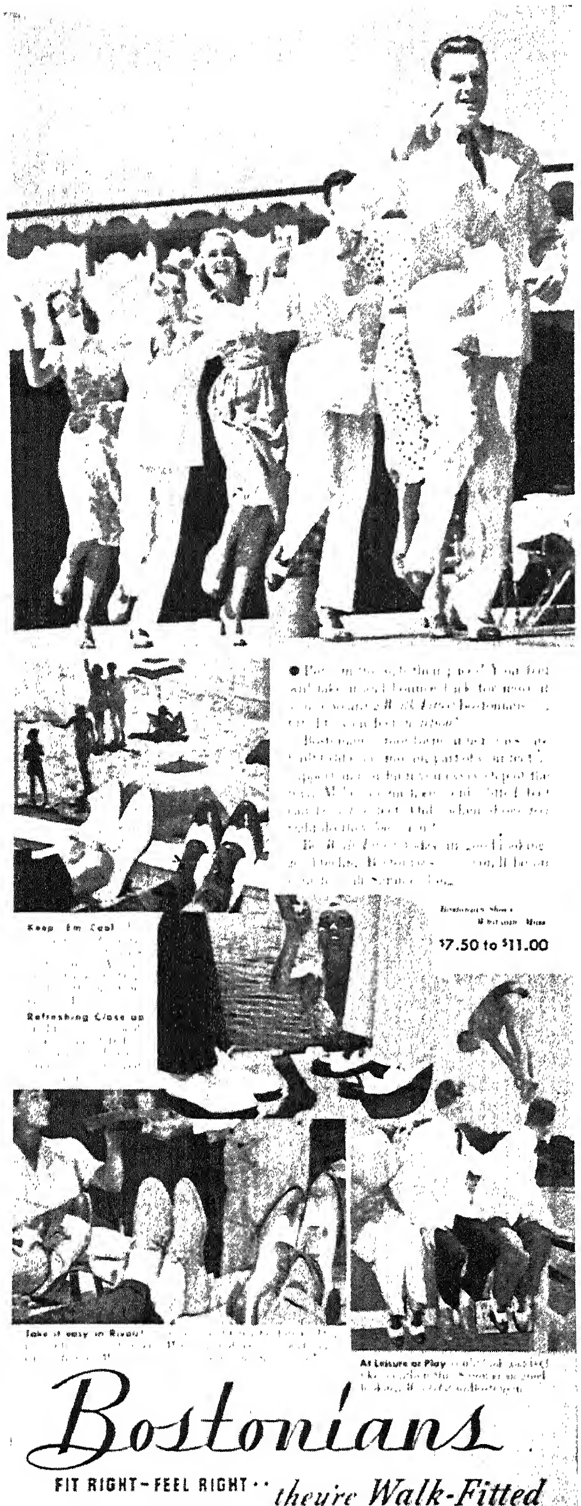
One of our scenes in this shoe series illustrated the caption, "Bring 'em back alive!" After several trials, we were convinced that the picture as planned lacked punch. We were trying to sell shoes, consequently we were showing shoes; we were trying to dramatize shoes. Casting about for a new idea we happened to notice a couple of youngsters, boy and girl, trucking gaily. Their shoes were eye-catching, arresting, as they flashed back and forth in the antics of the dance. Here was something with appeal, something typical and of

news interest — a boy and a girl enjoying themselves in the giddy raptures of the latest dance steps — incidentally they were showing shoes. We decided to use the idea.

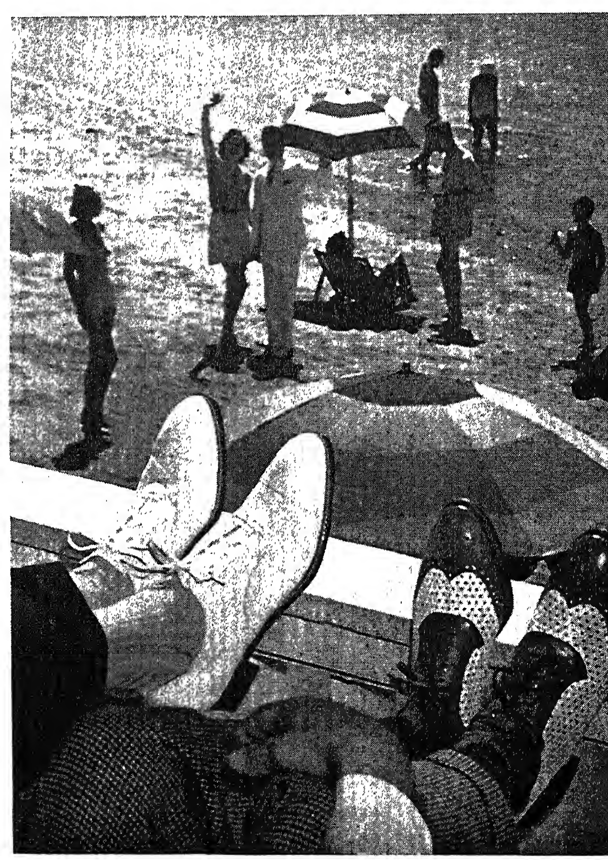
Posing the models as you see in the illustration (Fig. 12). I used an E, 23A filter to get a neutral, summery sky, the camera was set at 1/1000 second and for a focus of 12 feet I selected a 5¼-inch lens to get a pyramidal composition.

Although we were selling men's shoes the reason for the girl model is obvious. Their presence in any "ad" is eye-compelling. They are the "stop" element. You will notice, too, that one beautiful girl is especially prominent in the picture. This was planned composition, not accidental. She focuses attention on the action. At the same time, men's shoes were not forgotten. Though they appear only casually they are clearly defined, their style and texture easily seen.

A successful photographer must be an actor, director, and photographer. To get the models to understand what we were after, to make them see what we wished to create, I, and I'm no Paul Draper, had to



10. Actual advertisement showing how the shoe photographs were used in the complete layout.



11. Synchro sunlight flash, using one flash bulb to illuminate foreground. Note extreme depth of focus at small diaphragm stop. 1/100 second, f/32, Fast Pan film.

12. **TRUCKING.** 1/1000 second, f/4.5, E, 23A filter. This picture is fully described in the text on the opposite page. Bostonian Shoe account for Fuller, Smith, and Ross Agency.

give my camera-angle and timing version of the dance. Under the eyes of a critical audience ready to give me the laugh I "trucked" intently, if not gracefully, down the boardwalk. Then models were arranged, and, to the time-beat of one of the assistants, they began "trucking." They went through this routine till foot-motion was synchronized and the most pictorially photographic angle of the dance had been perfectly timed. Then, the action shot. The range finder is of prime importance here, for once your models have entered into the spirit of the picture it is a mistake to halt them for refocusing. It is best to let them go through the action and check your focus as they move along.

Action pictures can't be posed. I've tried it; I've seen it tried. I still haven't seen a successful one. Action must be caught by the camera as action. You cannot in a posed picture catch the free ripple of an active muscle, the swish of a skirt, the abandon of graceful body action.

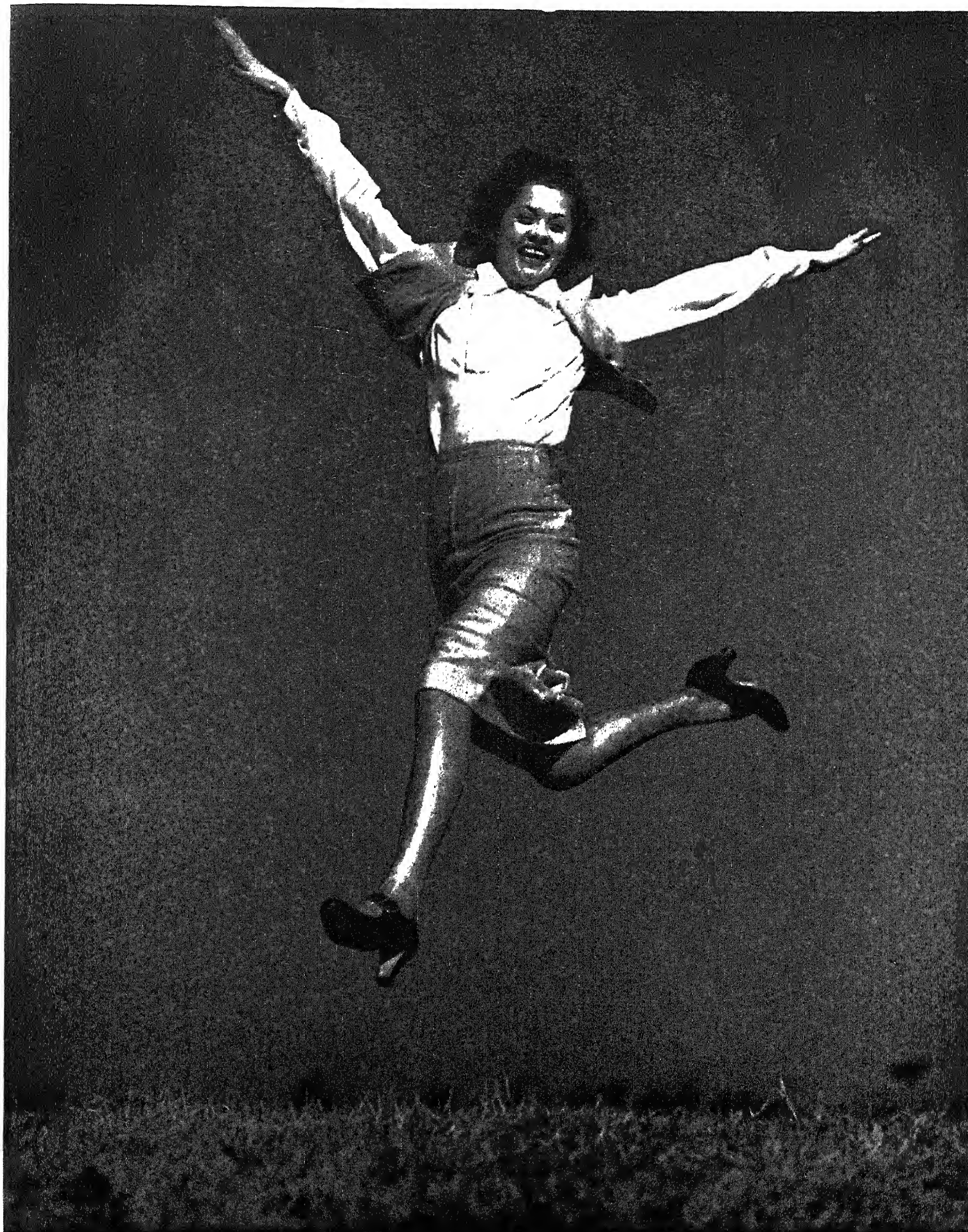
A direct contrast to the "trucking" picture is shown in Figure 11. Here the product advertised is not casually suggested. It is brought directly to the reader's attention and background becomes entirely secondary. In this shot, the shoes in the foreground were lighted with a synchronized flash to overcome the shadows of the balcony, and the background was allowed to fall into simple black and white so as not to detract from the merchandising point of view. With an f:32 stop at 1/100 second I was able to stop any movement of the people in the beach background.

Both these types — suggestive and direct appeal — are widely and successfully used in commercial advertising. The direct method must be used with prudence. It is easy to overemphasize, and a too blunt treatment of a subject tends to create an "anti-sale" reaction.

On this shoe "job," we worked three days. Twenty-five of the original situations discussed at the first preliminary conference were used. By observation and quick work we were able to bring back some seventy-five other original pictures. One hundred pictures in three days may seem slim gleanings for so many hours of work, but every one of those pictures was a planned

13. WOMEN'S FASHIONS. For *Good Housekeeping* Magazine. This photograph is typical of the effort made to give the magazine reader seemingly unposed and unplanned photographs. A week spent by the editor finding the bathing suit new in trend and with equal appeal to satisfy readers from coast to coast, hours of fitting, then a two-hour trip by automobile, one hour to wait for the sun to reappear, and then the photograph made in ten minutes while the sun was shining between black clouds. Exposure 1/200 second, f:11, K1 filter, Regular Pan film.

14. Actual advertisement layout featuring the girl shown in Figure 15.



15. Headline sweeping smart America off its feet . . . and on its feet. Illustration for the Red Cross Shoe Account of the Ralph Jones Agency. The visual called for a toned background to complete the art director's makeup for the ad. The action, although it seems like a simple thing, called for try after try on the part of the model before getting this picture. Exposure 1/1000 second to stop the feet action, f/5.6, E, 23A filter, Fast Pan film.

shot and each took time for execution — shifting location, changing wardrobes, and adjustment of equipment to meet constantly fluid lighting conditions can't be done nonchalantly.

I do not believe any camera other than the Speed Graphic could have done the job so successfully — its quick change of exposure range, its Kalart coupled range finder and general adaptability to the demands of quick thinking make it the ideal instrument for the illustrator.

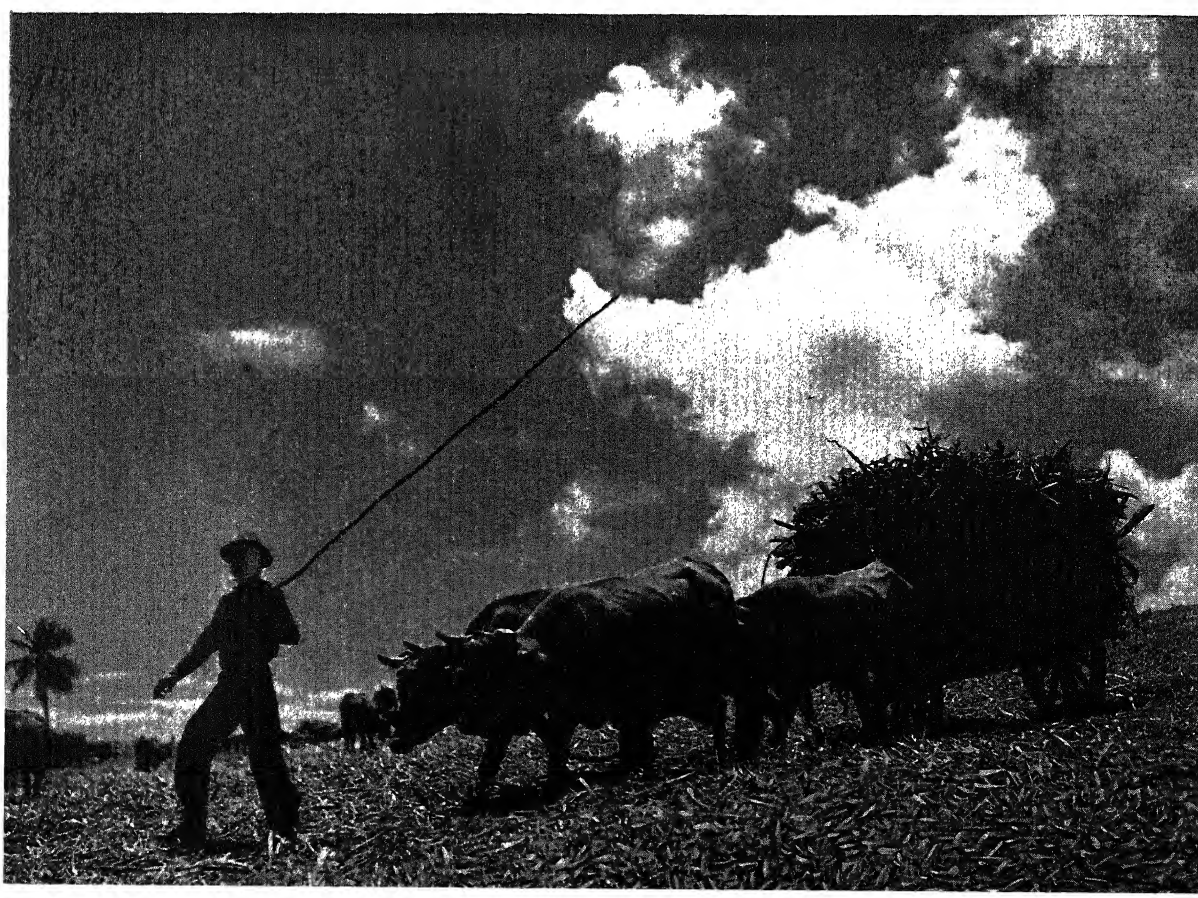
Travel Assignment

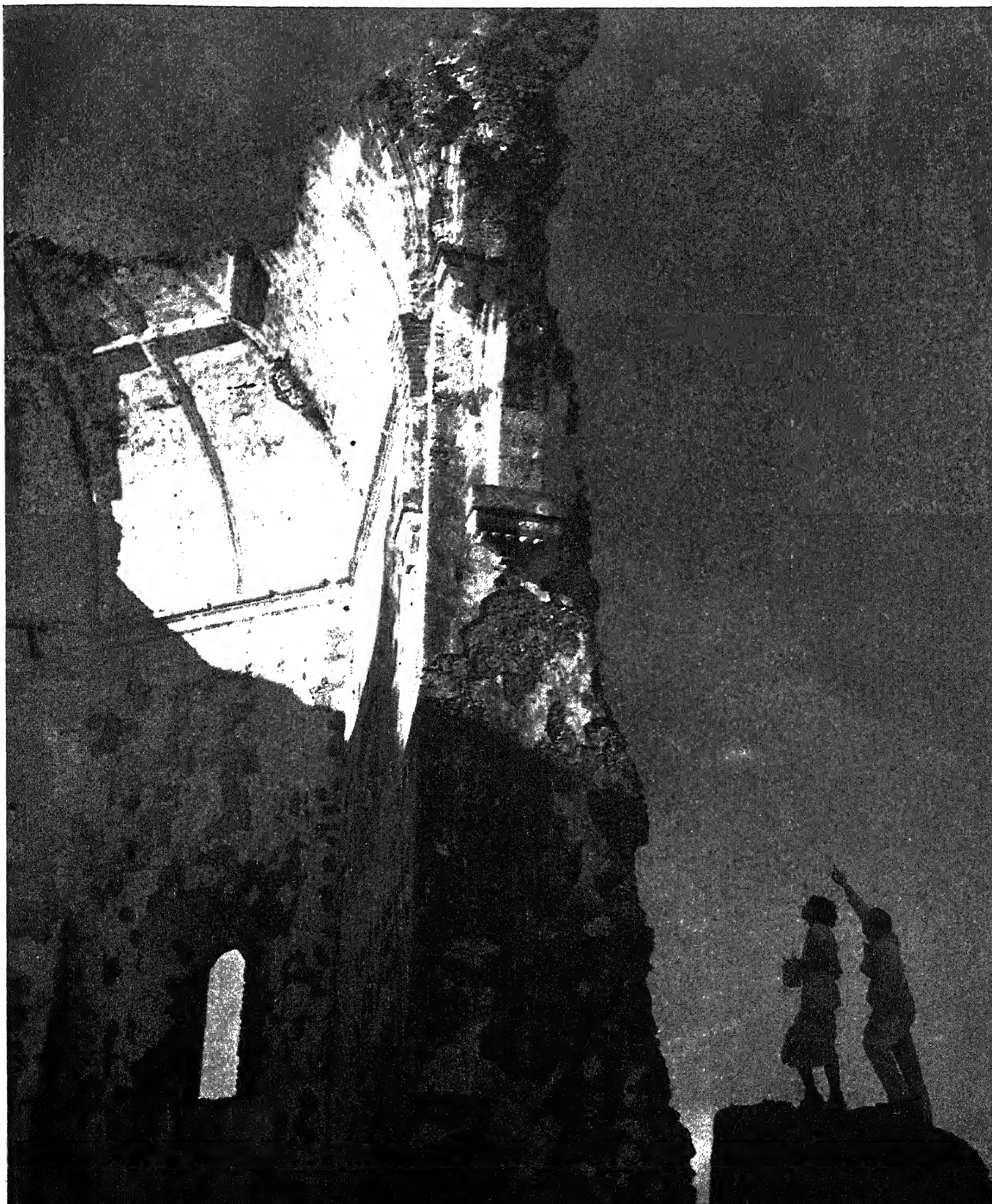
Many people, I believe, think that the commercial photographer has hours and whole days in which to plan and compose his pictures. This may be true for the pure pictorialist, it is not true for the commercial illustrator. Time and cost haunt his every working day. He must plan and work quickly. Another and interesting assignment illustrates this point. A steamship company commissioned us to picturize "a pleasant vacation spent on a cruise." We were to make a set of photographs for two- and four-column ads, brochures and direct-mail pieces, which would cover the story completely.

As in the shoe campaign, we faced the multiple problems of constantly shifting light conditions and an almost infinite variety of potential subject material. In this type assignment, the story calls for indoor and outdoor locale, stateroom shots, dinner, bridge, and cocktail hour scenes; swimming pool and sun deck, sports; the inevitable tropic moonlight and romance angle, and pictorial views of the countries visited. To carry heavy cameras, tripods and batteries of lights on an assignment such as this would turn the illustrator into a mechanic and throttle down his work to time and cost-devouring slowness. For this reason, I went equipped with only two Speed Graphics and adequate flash outfit.

Passage was booked for us aboard one of the company's boats. Having boarded ship, models were assigned their clothes and directed to lay them out in ordered sequence for morning, afternoon, sports, and evening wear. Obviously, we carried along a tremendously large wardrobe. Variety and frequent change

16. Oxen picture, made on Puerto Rican location. This is the unplanned picture described on the next text page. Although picked up on the run, the shutter was not released until the oxen and man were in the proper relation to the clouds in the background for a pictorial composition. Exposure 1/295 second, f/8, A, 25 filter, Fast Pan film.





17. This planned pictorial picture is described in the text on the next page. Exposure 1/50 second, f:11, F29 filter, Fast Pan film.

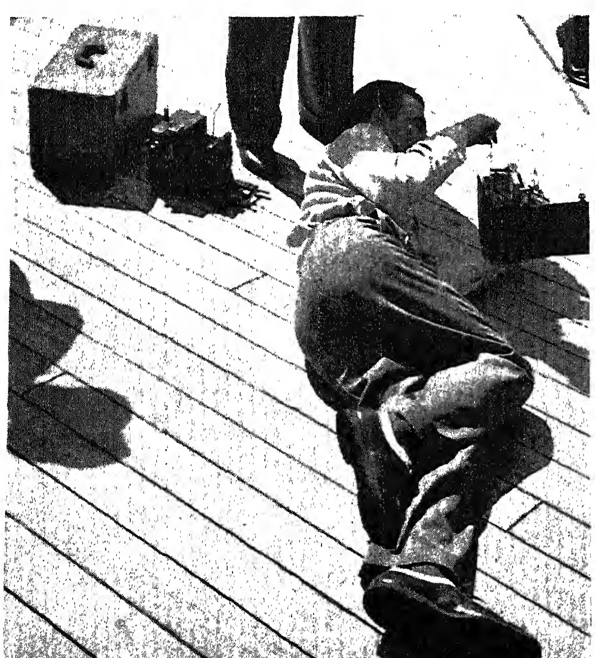
were essential. In this end of the job the good taste and cooperation of my models were invaluable. Their feeling for style, their quick willingness to enter into the spirit of the trip and their readiness to interpret my requirements saved me many hours.

In Figures 16 and 17 two types of illustration are shown — the one planned, the other happily caught on the run. Neither took over ten minutes. The picture of the oxen, taken out-side of San Juan, was picked up accidentally while riding through the country. We just happened to see the ox-cart as it drew slowly over a hilltop. The picturesque, plodding beasts, the pole and leaders in the man's hands, the lovely cloud effect had all the elements for a pictorial picture. Camera ready, the picture was captured. Here again, I used the range finder for checking focus and an A25 filter to tone the sky to the desired graduation.

In Figure 17, we have a deliberately planned pictorial picture. Against a background of crumbling ruin that suggested the majesty of dead and forgotten days, the two models were placed and rehearsed to suggest that element so important in cruise and tourist pictures, the present and the past, the familiar and the strange, up-to-the-moment style and beauty contrasting sharply with the chill, historic past. The picture was made with an F29 filter and the foreground was cropped to give the feeling of great height.

After the West Indies cruise, we found that by following our prepared shooting script—prepared on the first day out, all the elements of a cruise story had been covered when we left our last port of call and sailed homeward. Failure to establish a theme and work with it results, as a rule, in useless reshooting and a hodgepodge of unrelated pictures.

18. Photograph showing John F. O'Reilly in action with his camera aboard the S.S. "Empress of Britain" during assignment.



Other pictures throughout this chapter will, with the legend beneath them, tell their own story and explain why and how they were made.

Photographing for Specific Publications

Advertising today is a highly organized field and no advertisement can be successful without original ideas, clever layout, timely copy, and good reproduction. The photographer's job is to illustrate the headline, fill the layout, and make finished photographs that can be published successfully with the screen and engraving the advertisers use. Most agency men realize that the photographer has made a life study of his particular field and they are anxious to reap the benefits of his study and talent for the successful execution of their plans.

Of course, every photographer loves to dramatize his subjects by using various lights; however, when it comes to coarse-screen newspaper reproduction, it is necessary to stick to straight rules of photography. The illustrative photographer always asks his client where the photographs will be published. Also the number of the half-tone screen — whether it is to be coarse or fine. Once this is determined the photographer lights his subjects accordingly; for example, if one of the smart stores in New York City wishes to run a full-page ad in *Vogue* it is possible to use 133-line half-tone screen. In this case, the whole scale of tones from pure whites to pure blacks can be used. On the other hand, if this same picture is to be used in a newspaper where a 65-line screen is used, the photographer must try to fill in all the black areas and work for strong contrast. The lips and eyebrows are made up heavier in order to hold this contrast. In this medium there may be only 8 or 10 different tones in the picture, while the photograph for *Vogue* may have from 25 to 30 different tones. When delivering the newspaper photograph to our client we usually make a second print on a softer paper in order to show the possibility of obtaining more gradations in the print for finer screen purposes if necessary.

Fashion and Angles

The photographing of fashion tempts the photographer to try all types of trick angles. Some photograph angles only, others fashions only, while still others are able to combine both. And the man who can combine angle and fashion is a true fashion-illustrator. In fashion photography the photographer must feature the new fashion, which may be a new waistline, a longer skirt, or some other feature. To accomplish this he must

19. Through this entire campaign for the Saraka account the ads strove to show lively, vital, healthy people enjoying themselves. Marschak and Pratt Agency. For this particular picture we hired a thoroughbred show horse and a model who was an expert horsewoman. She rode the horse up and down the path a dozen times, always working toward the camera. I was afraid to run in suddenly as this might have frightened the horse and thrown the rider. You can see the excitement in the horse's eyes snapped just as he shied away from the camera. The model had instructions to ride the stirrup and wave when she was within 15 feet of the camera. Picture made at 12 feet, 1/1000 second, f:8, Fast Pan film.

study fashions very carefully and must work entirely from the fashion angle and not from the photographic angle.

Every season there is something new in fashions. The photographer can create dramatic angle pictures if design will stand it. However, any awkward view which will distort the fashion to be illustrated must be avoided. I would sacrifice everything for the photo, but still keep an eye on that new fashion feature in order to make it the central point of interest. The feature illustrated may be only a waistline, a neckline, or possibly a new sleeve length, but that's fashion and fashion is important.

Sport Pictures

In illustrative photography I am called on to photograph practically every type of subject and action. One of the interesting phases of this work is the photography of sports, for use in connection with advertising fashions, news photography, and so forth. One of the most obvious faults in sports photographs is their lack of familiarity with the sport itself. For example, I remember a polo picture made by a photographer who didn't know the difference between a polo and a croquet mallet. When the photograph was published in a national magazine advertisement anyone familiar with this sport could quickly spot the helmet on the polo player model which was too big for him, the wrong type of mallet in his hand, and his bad seat on the horse. These and other awkward features do not give a stamp of genuineness.

As a photographer of sports one must know how a jockey gets on his horse; how a football team operates, how the player holds the ball, how he runs or is tackled by his opponent. In this type of work, it is impossible for the photographer to bluff through a job if he does not understand the fundamentals of the game itself. In the past I had the opportunity to work with Grantland Rice, helping him illustrate many of his sporting books and articles, and from this association I did learn that the fan in every sport is a potential art critic. If the illustrator is not familiar with a particular sport let him

20. Children's Clothes Fashion picture for *Good Housekeeping* Magazine. In this picture we tried to show children's clothes in the most casual way . . . all the lines of the costumes can be seen and at the same time showing a pleasing child's photograph. Exposure 1/500 second, f:5.6, Regular Pan film. Picture made at high noon which I believe should be avoided whenever possible.

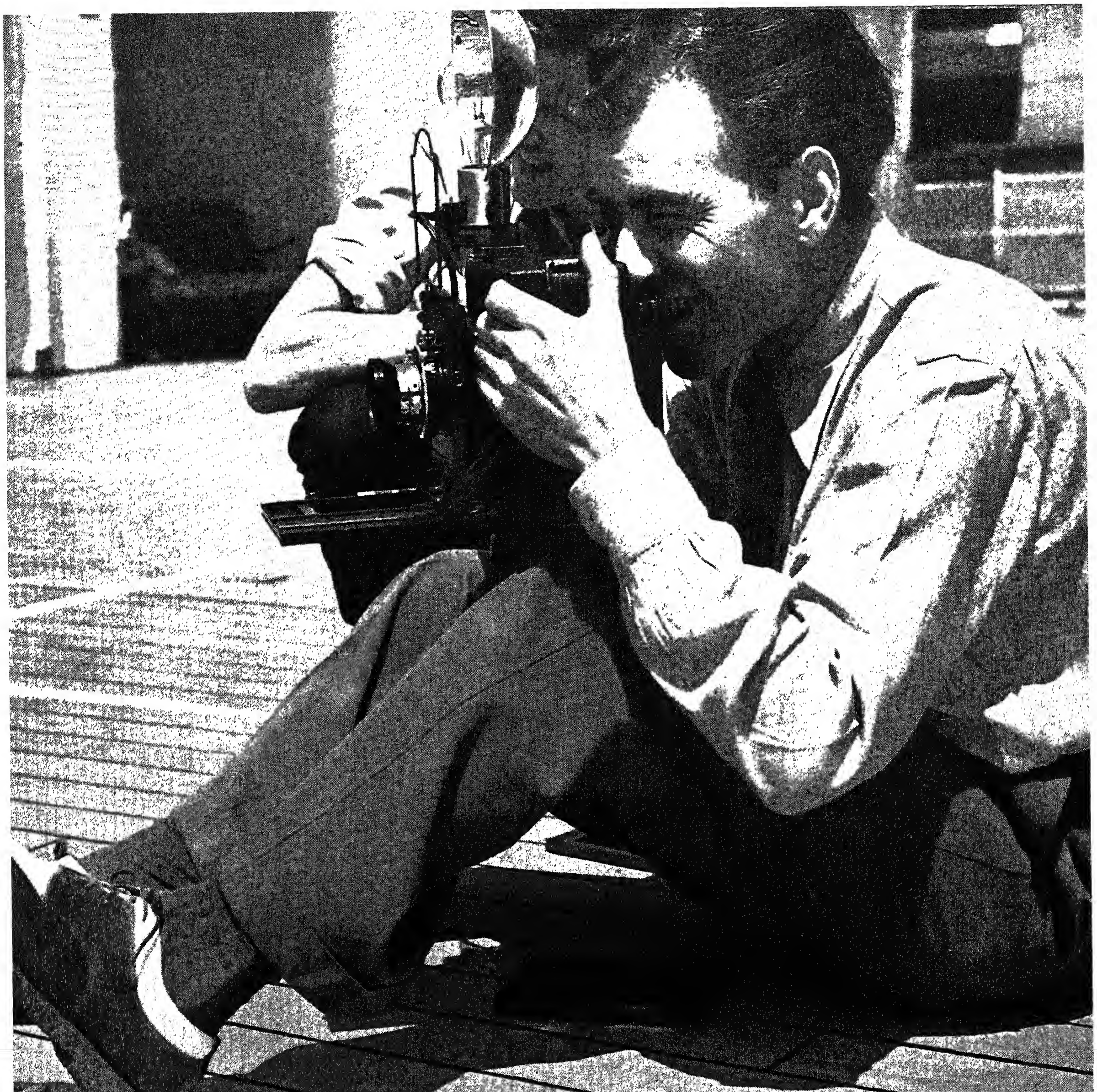
21. Photographs made on the S.S. "Empress of Britain" for Canadian Pacific Steamship Company through the Kenyon and Eckart Agency. The photograph below shows O'Reilly's position when he made this picture.

purchase one of the fifty-cent manuals and read it carefully. This will at least give him something to start on.

I am a great believer in careful research on any subject, whether it be sports, fashions, or stage plays. When I received the assignment to photograph Maurice Evans in *Hamlet* I sat up most of the previous night reading this play through for the fourth time. The next day when I went on the job I was so familiar with the lines and action that I was able to win the confidence and cooperation of Evans himself and get the picture I was after.

In the field of color photography, technique is now perfected to the point where color work can be produced with exactness and precision. I feel that the next big development will come from the creative photographer who will take this technical exactness and turn it into something really fine. I feel that this change is coming within the next year. Color photography still requires and will require considerable production time because of the necessity of such careful checking.

22. A photograph taken by Willard D. Morgan to show the behind-the-scene setup during the above picture. This picture of O'Reilly in action was taken by a 3¼ x 4¼ Speed Graphic. 1/100 second, f:16, Super Panchro Press film.



23. A photographic spread to show cameramen and models on location.
(*upper left*) Some of the models used on the S.S. "Empress of Britain" job. This picture shows models at ease. The photographer must animate these people into action for each special scene.
(*lower left*) John O'Reilly photographs two youngsters on the sports deck. Note the use of silvered reflector to throw light into shadows. Picture on lower right shows one of the series taken by O'Reilly in this position.
(*upper right*) John O'Reilly in action with his 4 x 5 Speed Graphic camera. Note synchronizer which is used for special outdoor pictures as well as indoor shots. A firm steady camera hold is one of the essentials of good photography.
(*lower right*) O'Reilly photograph made during position shown on opposite page. All photographs showing the photographer in action made by Willard D. Morgan using a 3¼ x 4¼ Speed Graphic, 1/100 second, f:22, Super Panchro Press film.

24. A typical travel type of advertising photograph made aboard the S.S. "Empress of Britain" for the Canadian Pacific Steamship Company for Kenyon and Eckart Agency. Exposure 1/295 second, f:11, Fast Pan film.

Processing and Darkroom Procedure

The news photographer and the commercial photographer must photograph under all conditions. Where the newsman may be able to get by with a picture, the commercial and illustrative photographer must turn out the highest quality job possible under all conditions. No excuses are accepted by clients for poor work. This means that every stage of the picture production must be controlled. One of the most important steps is laboratory control. In my own laboratory we use the standard Kodak ABC Pyro developer. A fresh bath is used for every new batch of films. As the developer is never used twice it gives us better darkroom control. Where several people may be using the same darkroom and chemicals, this method avoids any possibility of developer contamination. A standing tank developer may become partially exhausted or someone may splash hypo into it and thus throw off the developing time.

I am a thorough believer in using standard developers and the standard procedures recommended by the manufacturers of the various sensitized products. I see no advantage in trying to improve on this standard technique, developed on the part of the manufacturers.

In our darkroom, we use the developer at 65° F. to 68° F. This developer temperature never varies summer or winter. All lighting and exposures are made to work with this standard developer; for example, if I am exposing a film outdoors in dull weather it may be necessary to run the developing time of the film three to five minutes longer to build up contrast. On the other hand, if I am working under strong sunlight which tends to produce contrasty negatives I give full exposure and cut the developing time approximately two minutes or so. In my work it is better to have a soft negative than a contrasty one, in order to avoid chalky highlights and overexposed faces, which cause later printing troubles.

Conclusion

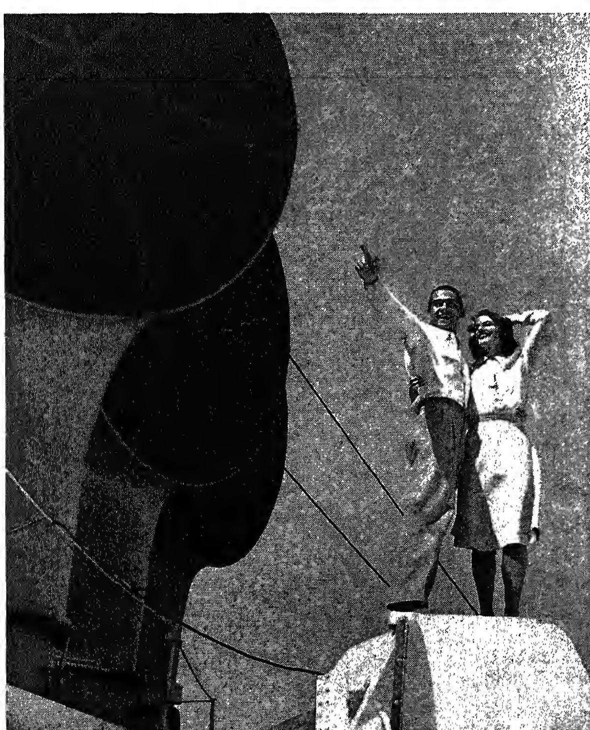
In the field of color photography, as I have already said, there are rich and untried regions tempting the curiosity and skill of all illustrators. In the field of the more familiar black and white, there is yet much to provoke the ingenuity and try the patience of the modern illustrator.

In Figure 3, I believe, the path of progress is illustrated.

Before the advent of the high-speed panchromatic film, this type picture was a sheer impossibility unless

25. Photograph taken by Willard D. Morgan from a side position to show a less effective picture because of camera location compared to the excellent shot on the opposite page by O'Reilly.

26. Photograph taken from same position photographed in Figure 25. This time camera was pointed toward O'Reilly during moment when he snapped the picture shown on opposite page. Note firm camera grip for steadiness.

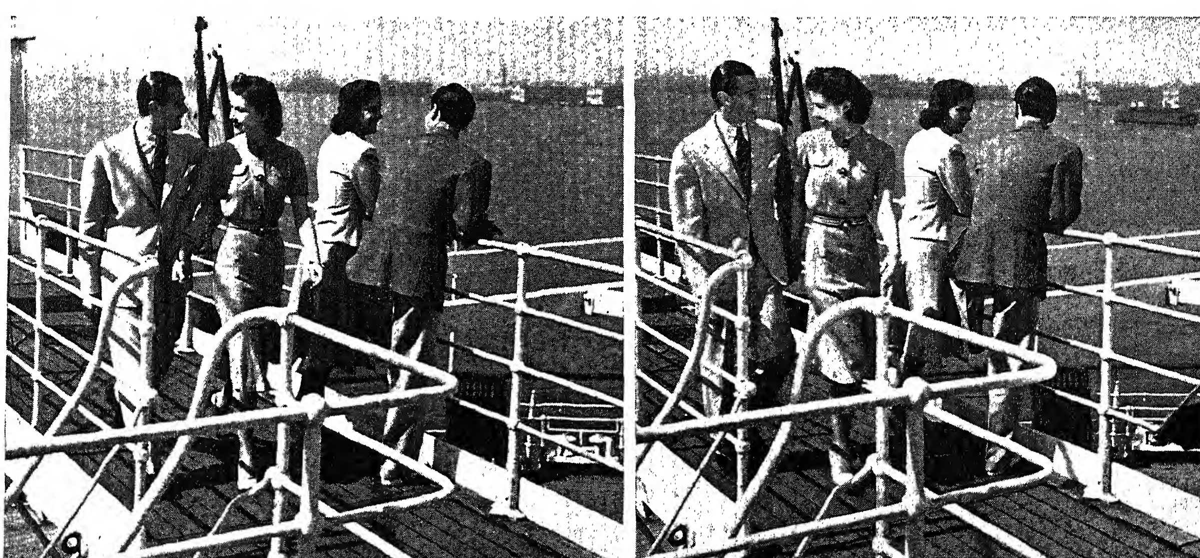


one had endless studio light resources. The Speed Graphic thus opens a new field for the average photographer. The focal plane shutter, as everyone knows, passes more light to the film than the between-the-lens type shutter, and when working in the studio with speeds up to an eight-hundredth or nine-hundredth part of a second, obviously this extra light is necessary and valuable. In Figure 3, I feel that I was able to capture the charm and rhythmic beauty of the dance. I used an f:3.5 lens on a 4 x 5 Speed Graphic with a total of 10,000 watts in lights. This type picture, I believe, will lead the way to "fresh fields and pastures new" in photography.

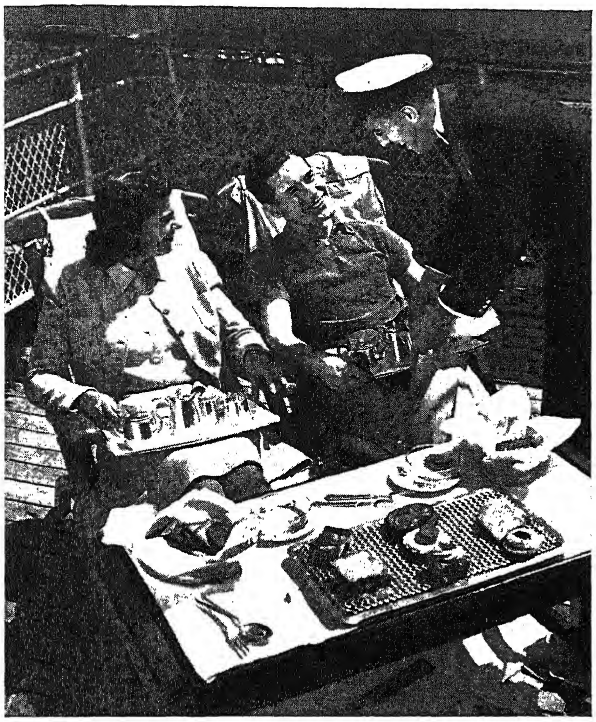
Photography yet has the freshness, the vigor, the beauty of youth. Before it lies fulfillment. Commercial and illustrative photography in its potentialities challenges every professional lover of the camera. The camera can accomplish in composition, in color, and in drama all that has been artistically achieved in the past. The constant technical improvement of photographic media dares the illustrator to utilize these laboratory findings for creative purposes. Nothing, I believe, is artistically impossible in the field of photography.

Talent creates fine ads. . . . The photographer has his appointed tasks in the creation of these ads. . . . We have been fortunate in having the opportunity to help. We know and realize that without merchandising men, copy writers, art directors and the many others who form this parade of talent, the present-day photographic illustrator would not have the opportunity to show his work. There is an old actors' axiom, "You are never an actor until you have an audience." The advertisers have given us the audience. This audience will always keep photography young.

27. Another S.S. "Empress of Britain" photograph showing travel type of photograph. See Figure 22 for position taken by O'Reilly during the making of this picture. Exposure 1/150 second, f:16, Fast Pan film.

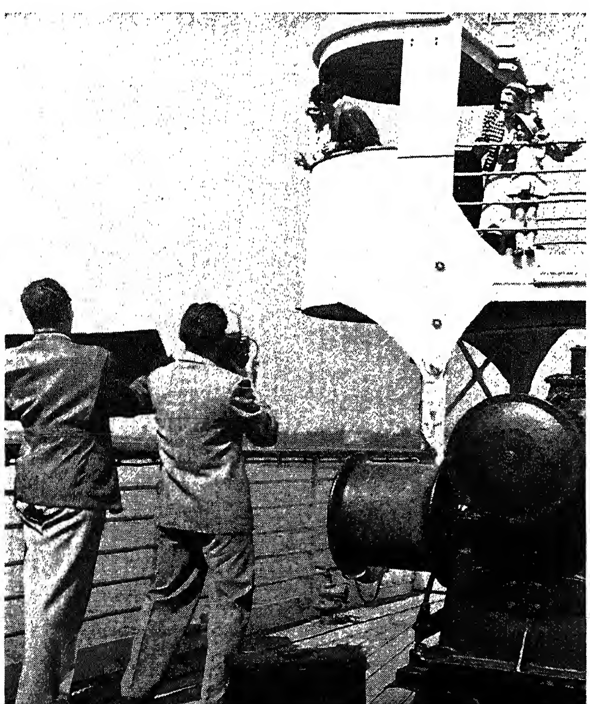


28. Two photographs taken by Willard D. Morgan from sidelines to show the effect of using a silvered reflector in daylight. Note that picture on left was made without reflector while picture on right shows the additional illumination thrown into shadows by the reflector.

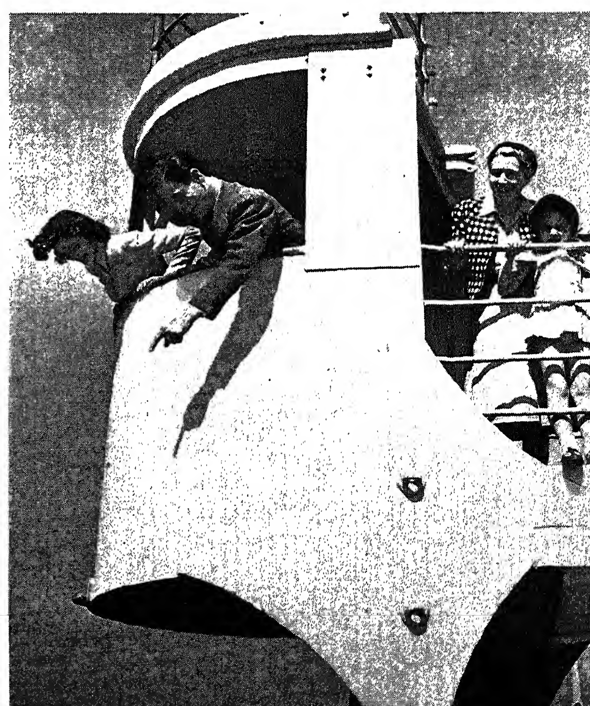


29. Photo by John O'Reilly while standing on ladder shown in Figure 30. 1/20 second, f:32, Fast Pan film.

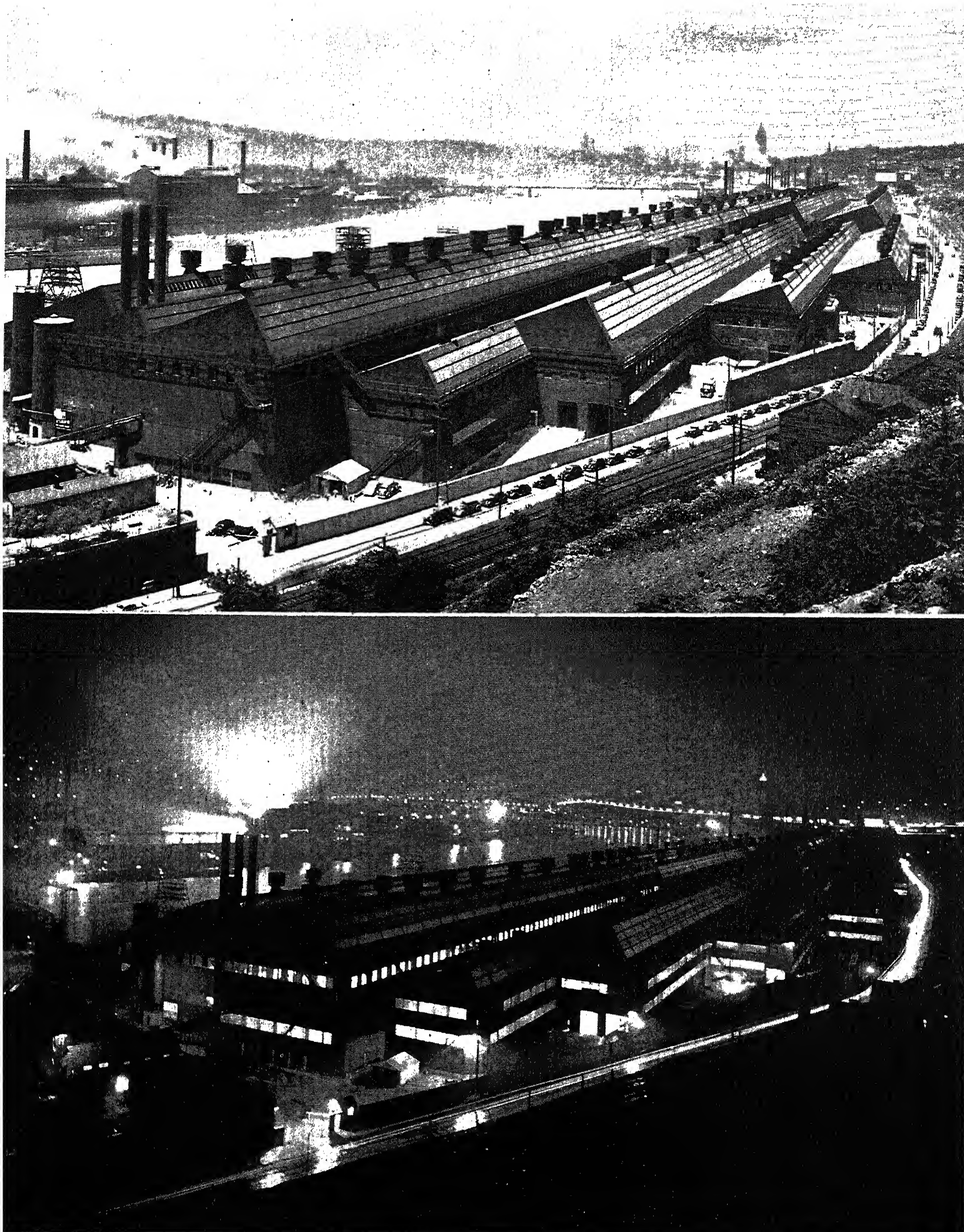
30. O'Reilly getting correct angle for Figure 29. 1/100 second, f:22, Super Panchro Press film.



31. O'Reilly standing on deck of S.S. "Empress of Britain" while making photo shown in Figure 32. 1/100 sec., f:22.



32. Actual photograph made from the photographer's position in Figure 31. 1/295 sec., f:11, Fast Pan film.



1. BY DAY AND BY NIGHT. Through the use of dramatic day and night contrast the Jones & Laughlin Steel Corp. in Pittsburgh was able to gain additional attention for their new $25,000,000 96-inch continuous strip and sheet mill. A similar use of day and night photography can be applied in many other localities.

PUBLICITY PHOTOGRAPHY

WILLARD D. MORGAN

The publicity photograph has attained a local, national, and international scope within a comparatively short period of time. Today, we find the local Chamber of Commerce of a small town using photographs to acquaint the public with its civic developments. On the other hand, we find national advertising, educational and political campaigns being carried on with the support of the publicity photograph. In the field of international relations the publicity picture has probably attained its greatest significance. This influence may be constructive or destructive. A nation can inform the world about its internal affairs through pictures. The present European war is a perfect example to show how photographs are used by various warring nations. These photographs can tell the truth as readily as they can spread false impressions and actual lies.

Magic . . . The Medicine Man of Modern Publicity

The tribal rituals, carried on through centuries of human development, resorted to incantation, rattle-shaking, and other illusion builders. Under their spell man might have imagined himself a super-being capable of tearing his enemy to bits. Woman found this tribal magic could give her the illusion of being well even if she were acutely sick. In some respects this highly developed art of early magic actually enters into our own modern advertising in various forms . . . the written word, the movie, the radio, the lecture, and the publicity photograph . . . all serve to whip up in this present day the desire to buy, express a new idea, or change a habit. The magic illusions of today find their strongest support through pictures, which cast a special glamour around a product or a pretty girl. Glamour in this sense is really a modernizing of ancient rituals, the transmission of a new feeling about a product.

An excellent example of this magic transfer is cosmetic advertising and publicity, where we find the perfect skin and ravishing beauty set up on a pedestal of honor. The publicity photograph comes into its almost exclusive use to show just how such beautiful women look. As a result, ten million other women have a desire to look the same. There is naturally no condemnation for the desire; in fact, it is probably a very constructive thing, but the whole point of this so-called magic transference can thus be illustrated.

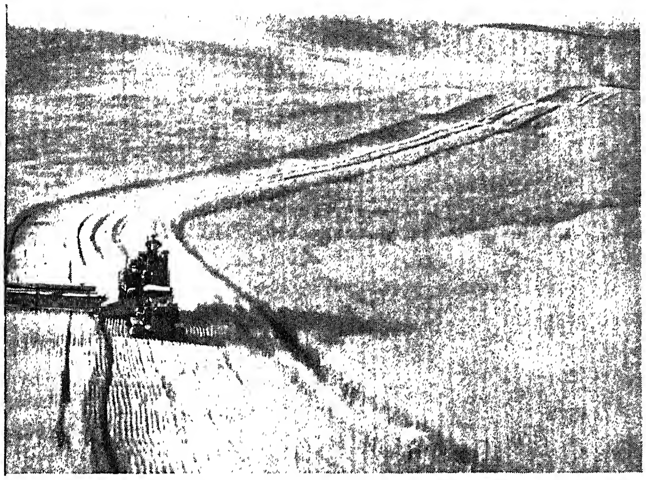
With such a wide range of concrete possibilities in this medium of photography, we find that the scope and ultimate limits in the field of publicity photography are endless. Every college and university, manufacturing concern, transportation line, resort, city, state, and national government, private organization, and innumerable other groups and combinations all resort to the informing medium of the publicity photograph, which may even be classified and defined as the public relations or educational picture, when it serves legitimate uses.

As a reading and buying public we are bombarded with these photographs every day of the year. They come to us in our daily newspapers, magazines, advertising booklets, posters, and other mediums. With the advent of television, it is only a matter of a short time before these pictures will come into every home by means of the radio.

The publicity photograph can tell its story to reach the rich as well as the poor. In either case there is the fundamental photographic technique which serves to create that elusive attention-getter . . . reader interest. Individuals, or small organizations with limited means. have a powerful medium in photographs. As a photographer you can find many ideas and a better understanding of this little-known medium by reading this chapter.

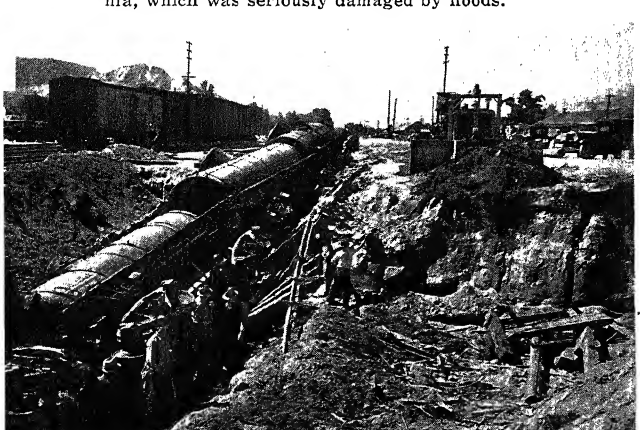
Regardless of the importance attached to publicity photographs there is one important link in their successful production. This is the photographer. He commands a very responsible position. His job is to interpret an idea; to make pictures which will inform a local audience or a whole nation. He can inform the nation overnight

3. EDUCATIONAL . . . This is a "cat skinner." A close-up detailed publicity picture for Caterpillar Tractor Company. O. L. Snider Photo.



4. SCENIC . . . "We call this our Old Faithful. Hundreds of prints have been made from this negative for publications," states the Caterpillar Tractor Company.

5. CURRENT EVENTS . . . Caterpillar Tractor helping to restore operations in railroad yards in Colton, California, which was seriously damaged by floods.



by releasing important photographs through the facilities of the Wirephoto network. When handling stories which have less spot news value, the agency or organization which hires the publicity photographer can distribute photographs to hundreds of newspapers and magazines within a week's time. These means for the almost instantaneous informing of the public, when we stop to really analyze the possibilities, may seem a little staggering and almost frightening. However, the publicity photographer must take these things in his daily stride. His success or failure depends upon the successful outlet of his photographs.

Publicity Drama and Glamour

We can place publicity photographs into several classifications, according to their importance and use. Various organizations and firms will have their own individual methods. For example, The Caterpillar Tractor Company of Peoria, Illinois, groups all its photographs under three main headings:

1. Educational   2. Scenic   3. Current Events

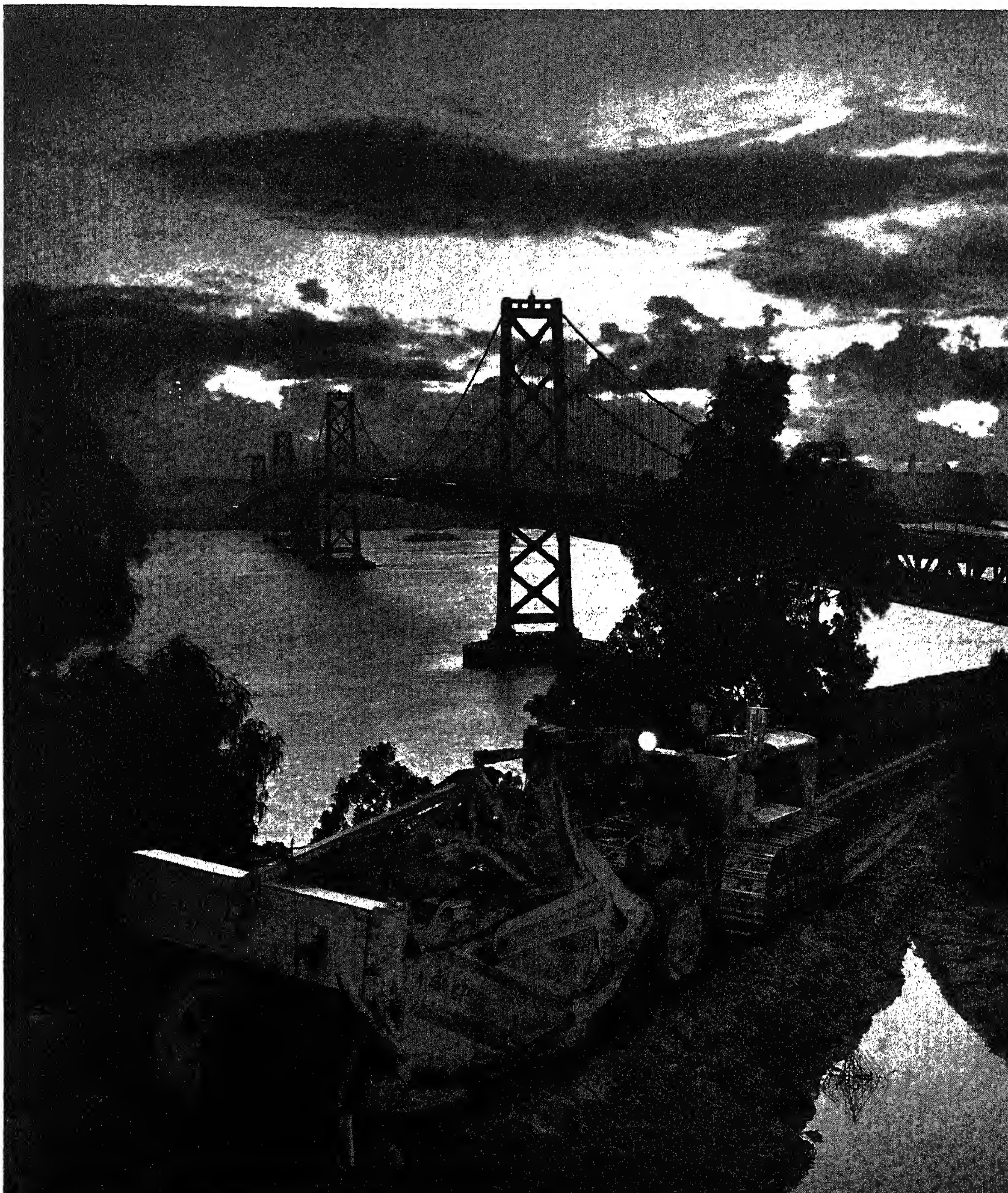
1. All photographs coming under the educational class must show excellent production performance, which is primarily of interest to trade magazines. These pictures should be well composed, showing the operator at his work and not taking a coy glance at the camera lens. In other words, the picture of a good job being done well.

2. Under the scenic picture classification, the Caterpillar Tractor Company endeavors to please editors who like good backgrounds and composition, foregrounds and framing, and filtered skies. In this type of picture the product is seldom in the foreground.

3. In grouping photographs of current events, they attempt to judge the worthiness of shots in a very similar manner to the way newspaper picture editors would select them. Human interest, spectacular subject matter, coupled with the importance of the event and the natural part Caterpillar products play in these scenes will all become elements in this type of picture.

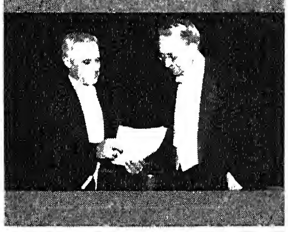
The Essence Of Publicity Pictures

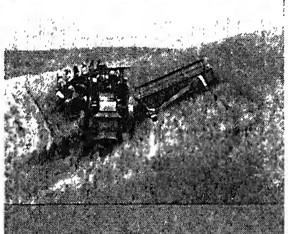
Every public-informing photograph deals with men, women, objects, action, color, adventure, great crowd interest, and scenes depicting life, movements, play, personal as well as international relationships, which provoke comments, discussions and decisions on the part of the public. In order to interpret such events, the public relations agent works with his photographer in an endeavor to dramatize and in many cases glamourize his product or subject. We have all seen photographs



6. SCENIC AND DRAMATIC . . . "Here is a picture which has really paid its way," states the Caterpillar Tractor Company. This photo by Roberts & Roberts of San Francisco shows excavation operations on Yerba Buena Island in connection with the Oakland-San Francisco Bay Bridge. Note the use of quick open flash exposure which picks up detail in shadows.

NEWSWORTHINESS .. BATHING BEAUTIES .. LIGHTING .. COMPOSITION .. TRAVEL .. CONSTRUCTION .. UNIQUE SITUATIONS





which look very stilted with this dubbed-in drama and unnatural build-up. Other pictures lend themselves to such methods and convey the idea for which they were planned. Naturally, the thing to avoid in all publicity photographs is a false forcing of the point. In many ways, the same technique holds good for the interpretive photo-journalist, as well as for the publicity photographer. Both photographers require a keen understanding of human values. They must be able to recreate scenes and expressions which will look natural in the finished pictures.

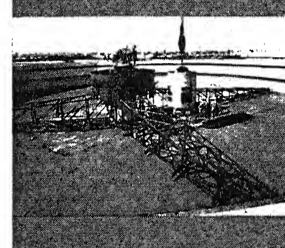
In the case of the publicity photographer, he is really in the role of a stage director. His pictures may cover a very simple scene, or they may involve complex movements of people. In dealing with such groups, he must always maintain the directing hand, and maintain confidence, so that his "actors" will follow in line with his methods. The success or failure of his work will turn the scene into hack-and-ham playing, or into the real human interest act.

What Makes A Good Publicity Photograph?

If we could present a single formula for producing publicity photographs, a miracle would have been enacted. The fact is, there is no single formula for the publicity picture. However, there are certain basic considerations and rules which contribute to the production of better photographs in this field. In trying to uncover some of these principles, we asked about one hundred publicity photographers and public relations executives the following question:

"What do you consider to be the basic requirements for successful publicity photographs?" The answers were extremely interesting. Almost every reply emphasized the requirements of human interest, good picture quality, good action, unique situations, and the connection with a personality, which may vary from the mayor to the current bathing beauty. Other miscellaneous qualifications for the publicity photograph may be summarized as follows: Newsworthiness, composition, general or specific interest for the individual publication, group or special field for which it is intended, pretty faces, unusual angles, transmission of an idea quickly and comprehensively . . . and pictures must have life. Some mention good subject material, and many, a personality, preferably an attractive woman, a unique idea or stunt, good backgrounds, correct lighting, faces well lighted, nothing that looks obviously posed. If a product is shown it should be shown in use, and the chief interest should center on the product itself.

Successful publicity photographs must be photographically perfect, artistic and if possible unusual to the extent that they will arouse in the editor a desire to use them. The photo-



9. PLEASURE RESORT PUBLICITY from Atlantic City. This caption was sent out with the photograph: "Little Mary Ann Sweeney, sweet, 18, and lovely, a telephone operator at the Knickerbocker Hotel, who has been nominated as official hostess to the other beauties in Atlantic City's 1939 beauty pageant. Visiting beauties have no fear — local talent is excluded. Too bad! !"

graph must also be of general public interest or of interest to the specific group of readers the publicity man hopes it will reach.

All of these requirements for the publicity photographs are extremely important. There are, naturally, other features to be considered. For example, the publicity photographer or agent might follow the advice of Benn Redwin Reyes of San Francisco, who states: "There must be a blending of the collective ideas of the photographer and the press agent. In making a picture I find that this is the best track to follow:

1. What basic idea am I trying to put over or interpret?
2. What am I trying to sell?
3. What type of people is it supposed to appeal to?
4. What medium is it to appear in?
5. How can I bring out the basic idea photographically?"

"There are naturally other considerations which arise depending upon the specific conditions. The whole idea is to make the picture as simple as possible so that it carries the story with regard to column space, depth, and reproduction qualities. There are various basic rules which must be observed in submitting pictures to different newspapers and magazines. Some won't use leg art. Some won't touch bathing suits. However, all will use girls. So with this in mind, we go ahead observing the basic rules with their variations."

Publicity vs. Information

Knowledge of the publication medium is basically important. It is obvious that photographs must be made with certain publications in mind. For example, Mr. H. W. Forster, Information Manager of the Western Electric Company, has this to say about publications: "Publicity implies an aggressive effort to go out and attract editorial attention. Our function is primarily to serve as a convenient source for writers, editors, and others who are interested in our industry and our products, and who desire information about them. We issue material on our own initiative only when we judge it to qualify as a piece of news, such as financial news, new products, technical developments in engineering, and the like. In other words most of our work is done **in response to requests,** and is thus more in the nature of an information service than publicity.

"In preparing our pictures for these needs, we try to observe the following requirements:

1. **For newspapers,** the news value of the subject comes first. Human interest and photographic qualities are important, but **news** comes first.

2. **For magazines** in certain fields, beauty is arresting, comparatively fine photographic qualities are vital.

3. For **others** a great number of engineering features devoid of all human interest will be essential.

4. For still **others** the aptness with which a photograph illustrates the theme of the text is the criterion. Naturally, better photographic quality enhances the desirability of the photograph in all cases."

The Scope Of Publicity Photography

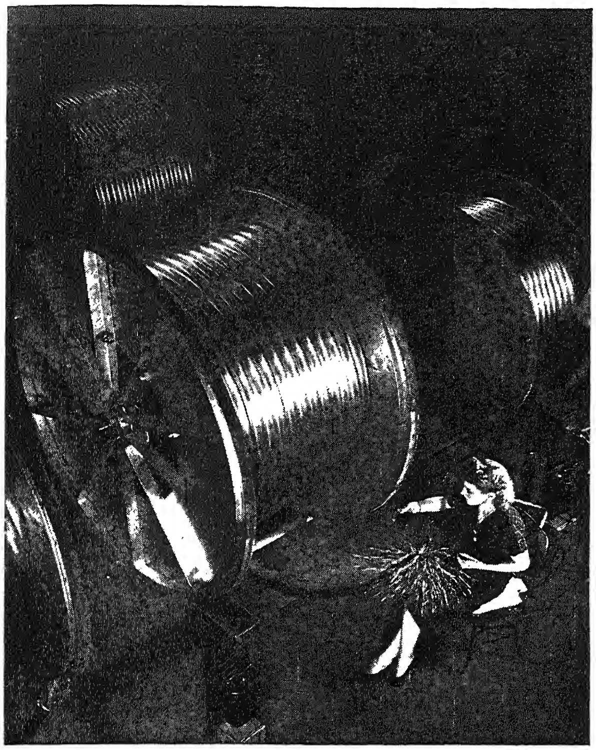
When the term "Publicity Photography" is mentioned, many people may simply have the association of bathing beauties in the local roto section, enticing travelers to Atlantic City or Miami Beach, or the antics of movie stars. Such pictures naturally come under the classification of publicity. However, the informative publicity picture goes much further than these obvious examples. In order to become aware of the wide scope of the informative photograph, we can mention the following subjects which are only a few among thousands: the alumni day, sports, dramatics, personalities, agents visiting the home office, room settings featuring linoleum floors, society column, bride and groom, exhibits, tulip festival, cherry blossom festival, rodeos, trailer coaches, the romance of trailer life, resorts, automobiles, publicizing bus lines, hospitals, buildings, factories, industrial and shipping scenes, public events and unusual conventions, technical developments and manufacturing methods, new products and their use, employees' activities, radio and stage, politics, recreation scenes, pretty girls covered with tokens, and current events.

In fact, there is scarcely anything left which is not subject to this interpretive publicity angle. The very privacy of living is brought out and presented to the public for commercial or private gain. Millions of dollars are invested in this work. There is an opportunity for the well-trained photographer in this work. Anyone with the special technical training combined with a sense of the dramatic and human interest interpretations should be able to command attention in this field.

Personalities

In our analysis of the publicity photograph we find that the important element of human interest or the personality covers the basic theme of the greatest number of publicity pictures. With this in mind, it is important that the photographer understand how to use personalities and direct them in his pictures. He will be called upon to photograph people who have attained distinction, such as: newly elected office holders, civic organizers, recipients of honorary degrees, or possibly the christener of a new boat. The photographs must convey the action and central theme so simply, so forcefully, that the picture editors will use the material. After all, a photograph made for publicity purposes is of no value to anybody until it gets into circulation.

To obtain these personality pictures, the photographer must be a keen observer of human nature. He must be able to create the scenes which are to take place later in the day, or possibly re-stage scenes which have already taken place. If it is a case of signing some important document, the opening of a new bridge, or the display of a new automobile, the photographer must



10. PHOTOGRAPHIC EXCELLENCE . . . Man-and-Machine interest. Telephone cable inspection. Photo by Holmes I. Mettee.

11. PERSONALITIES and good lighting. Hendrik W. van Loon "doodling" while broadcasting. Note excellent front and side lighting technique giving good reproduction quality.

give as complete an interpretation of the occasion as possible. Avoid the mummified handshake, the stationary stare of the people in the picture or the artificial grin which looks like a wax figure. Many hundreds of publicity photographers are guilty of producing such pictures.

Take for example the common scene where the mayor of almost any small city stands on a platform before an audience congratulating and handshaking somebody who has attained some temporary or permanent distinction. Invariably the publicity photographer misses the genuine handshake where there is really some emotional feeling present in the face as well as in the physical action of the people. This is the intense moment when the photograph should have been made. However, the photographer may tell them to "hold it." Immediately the subjects freeze. They stare at the camera with some sort of lifeless hand connection between them. Right here is where the keen photographer must be quick to sense a false tension. With skillful directing he can recreate any scene.

Importance of Lighting

Another extremely important factor in producing photographs for publication purposes is lighting. The publicity photographer is making all his photographs for publication in a newspaper with its limited tone reproduction features, or for the national magazine which has better reproduction facilities. With the publication medium in mind the photographer can give his subjects a sharper contrast lighting or a softer lighting with greater transition tones between highlights and shadows. No photographer can produce the best type of work without knowing how to light his subjects and also how to finish the final prints, unless he has a basic understanding of the publication requirements.

A careful study of the accompanying publicity photographs used to illustrate this chapter will show many real ideas which can be used. For example, with a very black background the dark hair of the subjects merges with the background without any separation. When such a photograph is reproduced in a newspaper the result is almost disastrous. There are ways to frame the head with a light background or some light object which will bring out the transition plane. On the other hand, there is the confusing background which carries the eye away from the central object or product. A background full of scattered details, in focus or out of focus, is just as bad as a foreground which is also overrun with extraneous details.

12. CONFUSING BACKGROUND . . . Regular fluff photo used by oil company to plug opening of new station. Composition and background detract from girl.

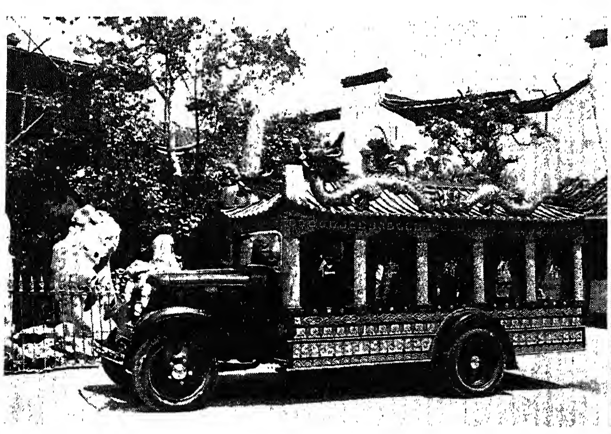
Of course, picture qualities, which include sharp detail, clear focus, composition, and the special black and white tone of the picture for detail, are taken for granted as part of the basic requirements for a publicity photograph. It is surprising how many publicity photographs are circulated that lack these fundamental picture requirements. When a photograph is sent out with light tones which do not give any transition of details it is automatically thrown in the waste basket the minute it hits any editor's office.

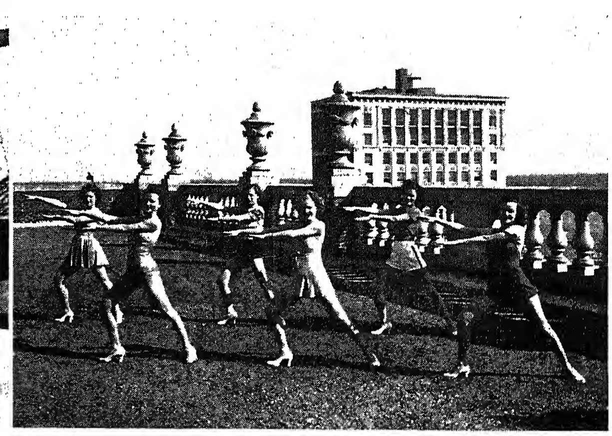
A photograph must have basic strong lines which will carry through the reproduction processes. Other photographs may be made of a product with the main object not in complete focus. Here again the photographer is at fault. Take the photograph of the girl holding a cherry pie which is symbolic of a cherry festival. The pie, which is the main theme of the picture, is out of focus. When a picture like this is reproduced, it will look as if she were holding a round plate of potato salad or anything but a cherry pie. Of course, the problem of photographic lighting is involved in every picture. Without light there is no picture.

The Synchroflash Publicity Picture

In the case of Synchroflash Photography there is a chance for the photographer to uncover more technical problems which can work to his advantage or disadvantage. With the advent of the synchronized flashbulb the photographer has been able to extend his scope of possibilities tremendously. He is now admitted into society circles, and wherever there is activity, and wherever people meet. The flashbulb has become an accepted and safe light source, carrying an intensity which outrivals sunlight. With such a powerful and flexible medium available there is no excuse for not getting a picture.

The obvious mistake a photographer makes is to use one flashbulb in the camera, and blaze away around any personality who wishes to be presented through the publications. Single flash lighting often tends to produce overexposed negatives which are printed in a publication only when nothing else is available. This is the chalk-white-staring-flash-face which we often see reproduced. There is absolutely no excuse for such pictures. They show that the photographer has taken the easy way out. With a little better planning and directing of the subjects he could have produced photographs of finer quality. To obtain this quality we can use one or two extension flashes synchronized to the camera, or one flash in combination with a reflector, to throw light back into the shadowed area.





13. CONFLICTING BACKGROUND . . Two photographs showing confusing backgrounds. The ornate Chinese Ford hearse should have been photographed with a less confusing background. The girls at the right have all the background columns to fight with instead of a neutral sky or wall.

By using multiple flash it is possible to obtain a better roundness and also a more pleasing texture and perspective in a picture. Backgrounds can be controlled by giving more or less light. Foregrounds can be brought into sharper focus by stopping down the diaphragm because there is extra illumination to work with. Any photographer who resorts to just one single bulb, stylizes flash lighting and is sure to brand all his work, which will lack sparkle and spontaneity of interest. Therefore, careful study of this subject is extremely important. Other paragraphs in this book give the basic principles, but in the long run it is up to the individual photographer to interpret and adapt this information for his own specific requirements. With a better understanding of flash lighting, we will no longer see the society matron or women's club president bathed from head to foot in all the hard brilliance of a flashbulb photograph.

There are other points to watch for in making the publicity photograph. For example, avoid having faces in shadow or covered with large hats. The use of a synchronized flashbulb can very easily eliminate such defects when photographs are made out of doors. Also avoid artificial work on prints if possible. Don't paint in eyes and lips and other details if it can possibly be avoided. Such artificial props must be resorted to because of a photographer's inability to produce a good picture. There are some changes which must be made when preparing photographs for special publication, such as blacking out backgrounds or subduing part of a print, so that a box of type or headline can be used over the photograph, but the photographer can do a great deal to eliminate much of the retoucher's job when he is making the original exposure.

Photomontage Publicity

So far the technique of photomontage has not been used very extensively in the field of photographic publicity. Probably one of the reasons for this is that the idea may have appeared to be a little too complicated. On the other hand, there is undoubtedly a definite publicity angle in the use of photomontage properly done. The conception of a pile of snapshots drawn into acute angles and pasted together is certainly not what we mean by the special publicity photomontage. The whole aim is to simplify an idea and yet present it forcefully in one picture. The finished picture may be the result of several negatives worked together to achieve the final montage idea.

The accompanying photomontage is a very simple application. It was used at a summer resort to publicize a costume ball at a girl's camp. This montage photograph was made on a 16 x 20 paper and then mounted on a cardboard with special lettering announcing the event. A complete chapter explaining all the methods in making photomontages for personal or commercial use is presented with 30 illustrations by Barbara Morgan in the Morgan & Lester book MINIATURE CAMERA WORK.

The Publicity Camera

It is probably safe to estimate that the majority of publicity photographs are taken with Speed Graphic and Graflex cameras. During the last few years the Speed Graphic camera has been especially popular in this work. In addition to the regular black and white negatives there are many thousands of professional Kodachrome films being used in these cameras. For example, the Speed Graphic camera used by the American Airlines' publicity department has turned out dozens of marvelous Kodachrome pictures for use in various publications.

14. SELLING THE PRODUCT. Claudette Colbert comes into the publicity picture for the card game, "Movie Millions."

15. MONTAGE PUBLICITY. A poster for Costume Ball made by Carl O. Morgan from two photographs.

Usually the $3\frac{1}{4}$ x $4\frac{1}{4}$ and the 4 x 5-inch negative sizes are preferred, because of the present standard set forth in many editorial offices. In many cases where exclusive publicity photographs are made, the original negative must be sent to the publication. Thus with their standard equipment these negatives fit right into the routine of picture making.

The chapter by John O'Reilly in this volume will give excellent and practical information about the use of the Speed Graphic camera in publicity and advertising photography. A careful study of this chapter is recommended.

The standard lens equipment together with one of the Synchroflash outfits is enough to cover most of the publicity requirements for the average photographer. Of course, there are times when longer focal length lenses may come in handy. Possibly one of these longer focal length lenses would be sufficient. After all, the basic Speed Graphic and Graflex equipment used in publicity work has actually become standard equipment. This equipment really becomes the vehicle for interpreting original ideas of the photographer and the publicity director. The camera will produce a technically perfect negative in the hands of the beginning photographer or the veteran worker.

Where To Send The Publicity Photograph

Veteran publicity directors know all the ropes in releasing pictures. However, many photographers who are surveying this field for the first time, or who are interested in developing their own business will be interested in a quick summary of the publicity outlets.

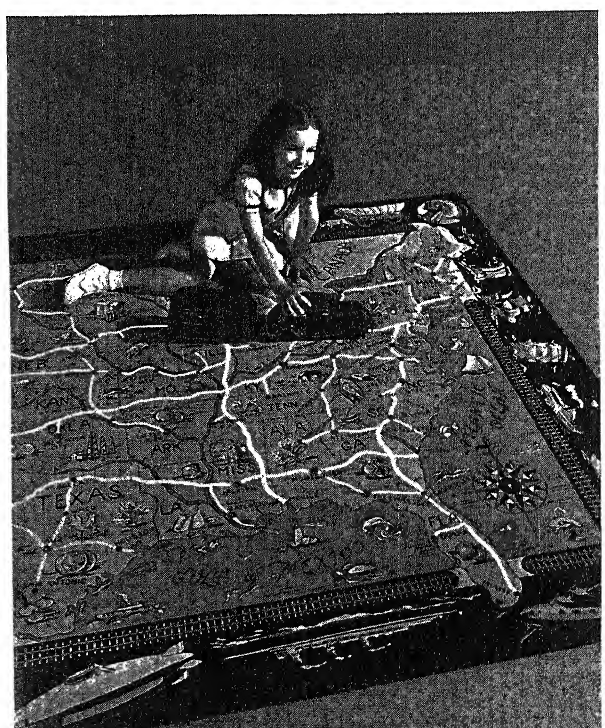
In the first place, the daily and weekly newspapers are the greatest consumers of publicity photographs. The editors of these publications can only use pictures which add something to their papers. This means that the photograph must have reader interest, which can come from a closeup of some personality, illustrating action, arousing curiosity, and photographs which are clear and devoid of confusing subjects. Read the chapter in this book on Reader Interest In News Pictures for more specific details.

The national magazines use thousands of photographs which come through publicity sources during the year. Here is where the photographs take on a new dimension in the form of short or long feature articles, special picture pages, and even front covers, or full-page inserts in the magazines.

There are various uses of publicity photographs in photographic exhibits, store window displays, office buildings and wherever people might be interested in seeing pictures. Other photographs find their ways into printed posters of all types. The various company house organs also use publicity photographs to advantage.

Still another very important outlet for publicity photographs is through the various **trade and classified publications.** Here we find nearly seven thousand publications in the field. Some of them are national, others local. In releasing pictures it is important to know their requirements. Some publications may be published to spread information on a special subject, while others may be of a more general editorial policy. Publications of this type cover such fields as steel, oil, insurance, automobiles, textiles, drugs, printing, chemistry, aviation, electricity, refrigeration, etc.

One of the first things to do is to classify all these picture outlets. For example, the conservative publications such as the *New York Times, Saturday Evening Post,* and others will fit one definite category. On the other hand, the more sensational publications like the *American Weekly, Look, Click,* and many newspapers, will use another type of publicity photograph. The third general group is the middle-line publications which avoid the obvious sensationalism, but yet try to convey the impression of a slight liberalism. A photographer should have some knowledge of the editorial background of these various publications while he is working on the job. He will thus have a more complete viewpoint of the whole situation. In fact, he may be able to make photographs for the different classifications simply by rearrangement of his subjects. A great deal of waste can occur when there is not a thorough knowledge of the editorial requirements of each publication. Therefore it is essential that copies of these publications be carefully studied along with any extra editorial information.

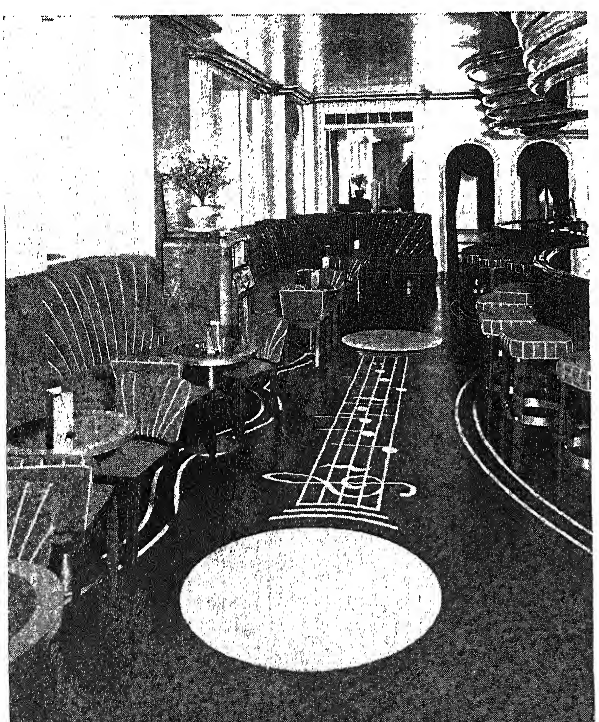


16. HUMAN INTEREST . . . One of the most successful publicity photos ever sent out by the Armstrong Cork Company. Map rug of the United States, showing highways, capitals and principal cities. Human interest, the travel theme and the inevitable fascination of maps are all tied up in this picture. The photo was accepted by picture syndicates, the trade and consumer press.

Information covering the best time for releasing photographs is also essential. There are certain days of the week when editors of some publications may use particular types of photographs. Also, picture pages are made up on a certain day of the week. Roto sections require their photographs on certain advance dates. Whenever publicity photographs which tie in with local or national news are to be used, the time element is of extreme importance, for here it is often necessary to stage a scene before the actual event takes place, in order to have the photograph ready for delivery in time to make particular editions.

There is also the time element to be considered in the engraving plant. Where written copy can be set up in type within a few minutes, a photographic engraving takes all the way from half an hour to several hours before it can be made available. Some newspapers and magazines have all their engravings made by an outside commercial house. This also adds to the time required in completing the final job.

This type of material follows the current news. It may cover just events such as conventions, annual meetings, new airplane testing, the opening and dedication of a bridge or dam or road or other project. In fact, any item of current interest should be released just as rapidly as possible. The difference of a few hours or even a day may mean the use or discard of a picture.



17. TECHNICAL INTEREST . . . This photo was used widely by trade papers in the liquor and restaurant field. It represents a tricky installation of Armstrong's Linoleum. Note that the music represents the first two bars of "How Dry I Am." This feature was played up, and it had a lot to do with putting over the picture.

A Specific Example of Picture Distribution

From San Francisco, California, we have the following information direct from Benn R. Reyes, who has several shipping accounts in addition to many others. We asked Mr. Reyes several specific questions about his methods of releasing pictures. His reply is of special interest:

I usually cover one ship a week, in and out. My photographer makes about four negatives on each of about five assignments. This in order that our local papers can be assured of exclusive poses. They will not touch our pictures unless they are exclusive. This amounts to about 20 pictures for the local press per ship. Then we service the East Bay papers. We usually send them the strongest stories in order that they might qualify as news features and not merely ship material. This amounts to about six prints per ship.

We also service the home town papers of the principals in the picture. We usually send along two prints. Something which they can use in one or two columns. This makes about 25 prints per ship for full coverage.

However, in most cases we figure our ship pictures in this way . . . We try to get at least one 'heavy' story. This is usually some business light or a 'culture-guy' such as a musician, writer, artist, etc. We can generally depend on space for this type of material. Then we fill out with 'fluff' or 'cheesecake' as termed by Eastern photographers. Whenever there is human interest material available such as children and animals, they are always worth a couple of negatives.

When one of these stories is particularly strong, we service it to the syndicates. These (Times Wide World, Associated Press, International News Photos, NEA and Acme), in turn, make up a series of prints which they send to their clients. Then, if a picture hits all syndicates it is serviced in excess of 100 prints. In the case of Acme, Central Press and United Press Illustrated, their photographic material is made up into mats and serviced in this manner to an undetermined number of papers.

It is safe to say then, that if a ship received this kind of coverage, we can expect about 150 direct prints to go out, exclusively of the mat services. Therefore, let us assume that I have two ships a week (one in and one out). Servicing about 100 direct prints on each, adds up to about 10,000 prints per year for both steamship companies. Added to this are the extra gags and stunts which we work on occasion, e.g.: A ship's baker makes a sugar model of the Golden Gate Bridge and we present it to the Mayor with ceremonies. Pictures of this are serviced locally and if strong enough, the syndicates will pick them up."

Preparing The Publicity Photographs For Mailing

Once you have gone to all the expense of making the original photographs a great deal of their effectiveness can be lost by the way in which they are presented for editorial use. In the first place, it is very essential that they be carefully selected. Do not send out copies of every negative made. Some publications might use a page spread, others might use one or two pictures, and still others might work something into a feature article with illustrations. By having a thorough knowledge of

the possible picture uses, the original picture selection, which is yours, can be made to fit each requirement.

The great majority of publicity photographs are all sent out in the standard 8 x 10-inch glossy size. The caption is neatly typed and pasted to the back or along the bottom of each picture. A publicity picture is worthless without its documenting caption. An editor must know who the people are in the picture, what they were doing, why they are there, and any other connecting links which will help get the picture idea into the publication. Be sure to attach the captions so that they stay in position.

In a few cases it may be necessary to have releases on a picture. The editor takes for granted that the photographer or publicity agent would not send out a photograph unless he had such releases. Also if a picture is sent out as an exclusive release this fact should be mentioned. The Caterpillar Tractor Company has an attractive little printed sticker which they attach to any photograph which is released exclusively to one publication.

It is important that all photographs should be mailed out with a stiff protective cardboard. It is surprising how often this precaution is omitted, and the prints arrive in the editorial office damaged. Another distracting habit is the use of paper clips or staples for attaching caption sheets. Metal clips always cause trouble by scratching or denting the print or by creating bad embossing.

18. WATCH YOUR ANGLES . . . A convention shot of speaker Rabbi Stephen S. Wise which received a fairly good publicity break because of unusual facial expression. However, lower half of photo should have been printed dark to avoid additional confusion, otherwise, photographer should have selected higher view point or made greater enlargement, which was done in another print. Everett Rudolff Photo. 4 x 5 Speed Graphic, 1/200 second, f:11, one flashbulb.

19. Dinners and banquets present difficult publicity problems. Usual photo shows principals strung out in long line with confusing flowers, candlesticks, and a microphone in foreground. When possible, remove such obstructions and avoid having candles sticking out of speaker's eye or ear.

20. PUBLICITY PHOTOS WHICH FAILED. Picture at left of the late Colonel Jacob Ruppert and Admiral Byrd's flagship is an example of bad composition. Colonel Ruppert and ship's name are too far separated. Next photo showing girl supposedly lighting a camp fire to bake a certain brand of potatoes in her parlor was a gag picture which flopped. Third photo from left shows publicity for a cherry festival in Ohio. Cherry pie is badly out of focus and whole picture suffers accordingly. Picture at right shows a pie which really is in focus. Publicity picture showing reward for best cooking.

Publicizing a New Product

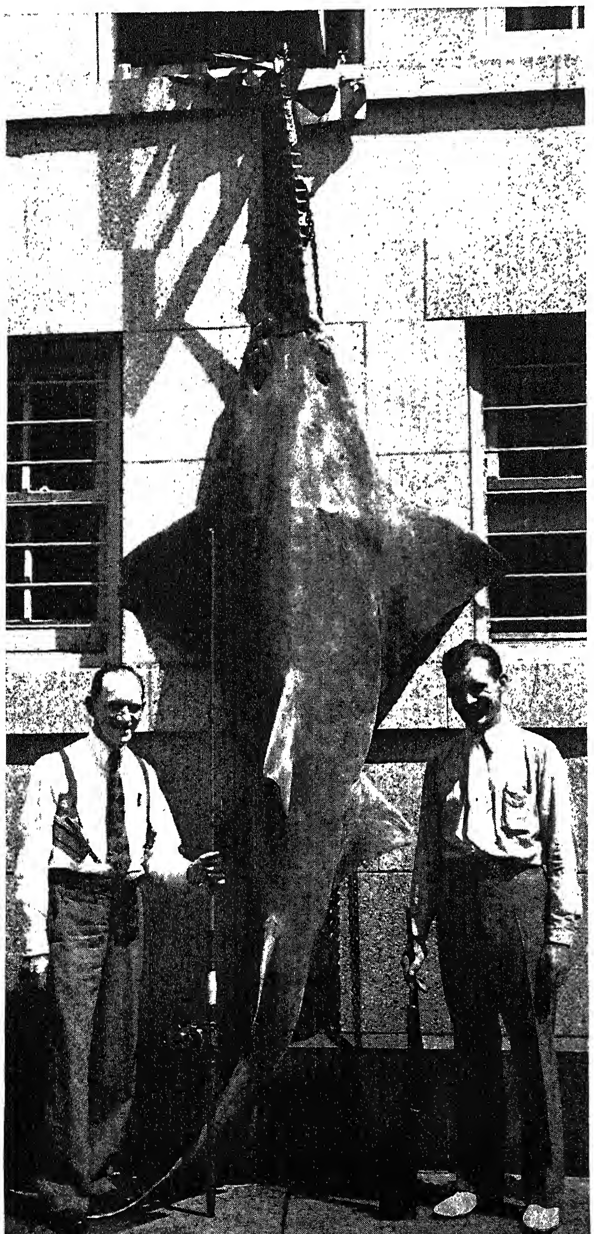
26. A new product (hair protector) introduced on the sands at Atlantic City, through the active work of the Atlantic City Press Bureau. The publicity agency is continually looking for interesting ways to announce a new product to the public. The pretty girl tie-up is always one of the quick and obvious methods for showing a new stream-line automobile, a new fashion in clothes, or practically any other product.

27. The Resort publicity agency uses the bathing girl for dozens of attention-getting photographs. Atlantic City's agency at work again to attract visitors to their beach resort through the medium of publicity photographs.

23. If two bathing beauties get attention, what about eleven? In other words, more emphasis and more public attention. Atlantic City News Bureau spreads this bevy of beauties along the shore line for quick attention.

How One Publicity Department Operates

In order that you may become more intimately familiar with the publicity methods of one type of organization, we have selected the American Airlines as an example. There are many other firms in every type of business where similar stories might be obtained. The following information from the American Airlines Publicity Office will be of immediate value.



The American Airlines News Bureau In Operation

Reading about the actual experiences of photographers and directors of public relations is always of interest and value. Edward G. Bern, Director of Publicity for American Airlines, is one of these veterans who eats, sleeps, and lives photographs. His 3¼ x 4¼ Speed Graphic camera goes wherever he travels to make pictures or direct the photographic work of his assistants. Mr. Bern concludes this chapter with his valuable observations. He writes:

In looking at pictures from a publicity standpoint, insofar as American Airlines and the aviation industry are concerned, I can say I consider them indispensable. Aviation publicity pictures create the desire to fly . . . that is their purpose . . . and every picture released by American Airlines' News Bureau is with this idea in mind . . . **selling air transportation to the general public.**

Many newspaper offices have large signs on the walls, asking their editors and reporters:

"Is it news?"

American Airlines could do the same thing in their publicity department, changing the phrase around to ask the question:

"Does it sell seats?"

Publicity pictures in aviation do this selling job in various ways. For example it may be a picture of a group of passengers, smiling, waving their hands in greetings to friends, departing in a "Flagship." That sells the idea that those people have enjoyed THEIR flight, nothing happened to them . . . so perhaps you might have the same experience if you broke down and made a flight.

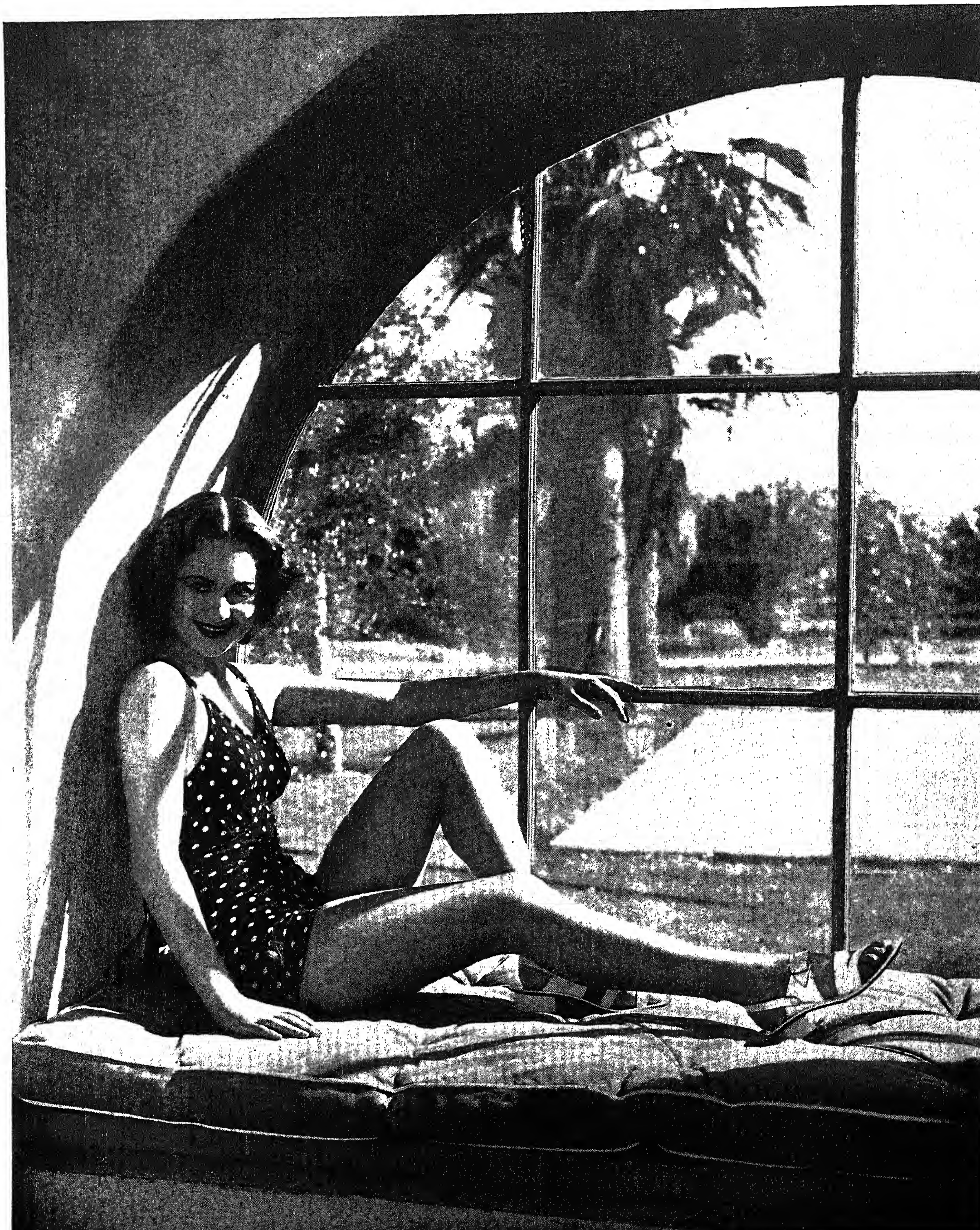
Another example might be the picture of a "Flagship" flying over a beautiful bank of clouds. That particular view was designed with the purpose in mind of creating the desire in the minds of non-air travelers to see such sights for themselves.

Reams and reams of news material and pictures have been released on airline stewardesses. Such material is usually acceptable to the newspapers because these girls are beautiful and photographs of them usually make an attractive layout. But on the airline's part such publicity is doing a real selling job. When a timid business man picks up his favorite newspaper or magazine and sees a beautiful stewardess in an airplane, he is likely to lose some of his timidness and feel . . .

29. THE BIGGEST, THE TALLEST, THE GREATEST, THE ONLY ONE. There is always a chance for publicity tie-ups with such variations. Here we see a 686 lb. sword fish taken on rod and reel in the Gulf of Mexico at Port Arthur. Photo by Hickey Studio. Released through Port Arthur Chamber of Commerce.

30. **THE GENERAL AND THE CLOSE-UP.** There is always the danger of showing general publicity views for reproduction purposes. Mechanical requirements require close-up detailed pictures to support general types. These two pictures show the drilling of dynamite holes during construction of the Shasta Dam. Photos released through U. S. Bureau of Reclamation. Note how closeup view at right gives complete picture of the drilling — compressed air blowing out rock dust during drilling.

32. **PUBLICITY CONTRASTS.** Here we have an American Airlines Flagship speeding away from an airport, contrasted against the old-time stage coach, forcefully putting across the progress of modern aviation by the American Airlines Publicity Department. Photo contrasts can be carried out for practically any subject or product. When well-executed the pictures receive favorable publication acceptance.



33. Attractive publicity for the El Mirador Hotel and also the Palm Springs Resort in California gains quick attention through this picture showing Olivia de Havilland. Frank Bogert, official Palm Springs photographer, used a 4 x 5 Speed Graphic camera and also a reflector to illuminate foreground.

"Well, if an intelligent girl like a nurse has chosen this profession to make a livelihood, then flying in itself must have things which I as a business man can utilize to my advantage also."

Thus, pictures create in people the desire to fly, the desire to see things from the air, and that is an important factor in airline sales work. And it has been proven that the hardest task of an airline salesman is in getting the prospective passenger to make his first flight. Publicity plays a big part in helping to do this.

The News Bureau of American Airlines, in taking and servicing spot news and feature pictures annually, considers itself doing a real service and acting as a source of information to the newspapers and magazines of the world. Airports are usually several miles from the center of cities, and very often there is a last-minute flash that a person of some social, political or entertainment world importance, is arriving. To get a photographer from the downtown office or from some assignment to the other side of town might take too long. So the picture editor picks up his telephone, calls the airline at the field, and his worries are over. Because he knows he can depend on the airline photographer to deliver a clear picture with news value.

It is a safe estimate that more than 60 per cent of spot news stories breaking on airlines and at airports in the nation today are covered by airline photographers and the papers serviced with the prints. In face of such evidence is it any wonder then that the picture desks of newspapers throughout the country look upon the airline news bureaus as real friends?

The Publicity Stock File

In addition to day-in and day-out spot news coverage, American Airlines also maintains one of the most complete black-and-white and color picture libraries in the aviation industry.

Today there are some 50,000 stock black-and-white prints in the files of American Airlines. These pictures cover every phase of the industry from the washing of the airplane wings to the intricate dials on the instrument panel of the pilot's cockpit. There are roto series covering everything from a pilot's physical examination to how a stewardess makes up a berth on a "Flagship" Skysleeper. And every picture in this file has been checked and re-checked until only those that are capable of doing a good selling job, when reproduced, are retained.

Aerial Color Photography

Color pictures are becoming more and more important and will continue to become more so in the near future. Fortunately American Airlines has been able to do a great deal of preliminary study and experimenting with colored pictures with the result that today we are running more color pictures throughout the land than any other publicity medium in a like industry. Last winter two staff photographers from the News Bureau spent more than a month in Arizona and Southern California, taking Kodachromes on the "Sun Country." These will be used during the winter in newspaper and direct mail promotions to sell people the idea of flying to this part of the nation to escape the cold winds and winter snows of the East and Middle West.

A staff photographer recently took a 4 x 5 Kodachrome with his Speed Graphic of a "Flagship" flying over Niagara Falls. Now thousands of color pictures have been taken in the past of the Falls—that in itself is nothing new. But to have a giant airliner flying over them all in natural color . . . well, that was something new. The result: We are now getting back full-page rotos in color from such papers as the Chicago *Tribune*, St. Louis *Post-Dispatch*, Syracuse *Post-Standard* and others who have reproduced this picture. To count the black-and-white clippings we have received back from this would be a big task because they have come from every section of the country and even as far away as Bombay, India.

Mrs. Franklin D. Roosevelt recently posed for almost an hour for our color cameraman in Ft. Worth, Texas. We photographed her checking in at the ticket counter, boarding the plane, knitting in her seat inside the plane and asleep in the cabin of the ship. These color pictures have been reproduced by *Colliers*, St. Louis *Post-Dispatch*, Minneapolis *Journal* and many others. They are doing a tremendous job of selling because they demonstrate the safety of air travel. It must be safe, after all, if the wife of the President of the United States takes it all so "matter-of-factly."

There are many, many more Kodachromes in American Airlines' files. We have them in 2 x 2, 3¼ x 4¼, and the larger 4 x 5-inch sizes.

Twice a month, the News Bureau of American Airlines releases to newspapers all over the country a full roto series. These, in the past, have covered such subjects as "Taking a Stewardess Through School," "Pilot's Physical Examinations," "Mechanical Aids to Flying," "Babies Who Fly," "Pilots' Hobbies," and many others. You must have seen them at one time or another because they have all been widely reproduced in such newspapers as the San Francisco *Chronicle*, Chicago *Daily News*, Dallas *News*, Ft. Worth *Star-Telegram*, Boston *American* and hundreds of others.

To handle picture assignments for American Airlines, the publicity department maintains four staff men, headed by Merle J. Oelke. One man is based in Los Angeles, another in Chicago and another in New York City. To handle assignments Mr. Oelke is on a more or less traveling assignment, being at the current time primarily engaged in color photography. All of these photographers have a good basic background in photographic work, although not necessarily in newspaper photography. Each one has a good sense of news values and would, if the occasion arose, be of value to the picture department of any paper.

In hiring photographers, we look for several things. First, of course, is his craftsmanship and sense of news values; second, his ability to think for himself and formulate new ideas; and third, his ability in being able to carry out an assignment to its ultimate completion in all details.

The servicing of pictures is a large item in the work of an airline news bureau. The way we go about handling this is by having a complete mailing list of all magazines and newspapers, in cities other than where we maintain offices, which use roto and black-and-white pictures. These we service direct. We also depend to some extent on the wire services and syndicates such as Associated Press, International News Photos, Wide World and Acme.

In cities where we maintain offices, but no publicity men, we send the pictures direct to the sales manager who in turn services them to the papers. This method has worked with great success. We also maintain a foreign service, mailing pictures and news material to a large selection of foreign newspapers and magazines once a month. Then, of course, our news bureau staff men are continually making calls on leading newspapers and magazines, selling pictures and stories.

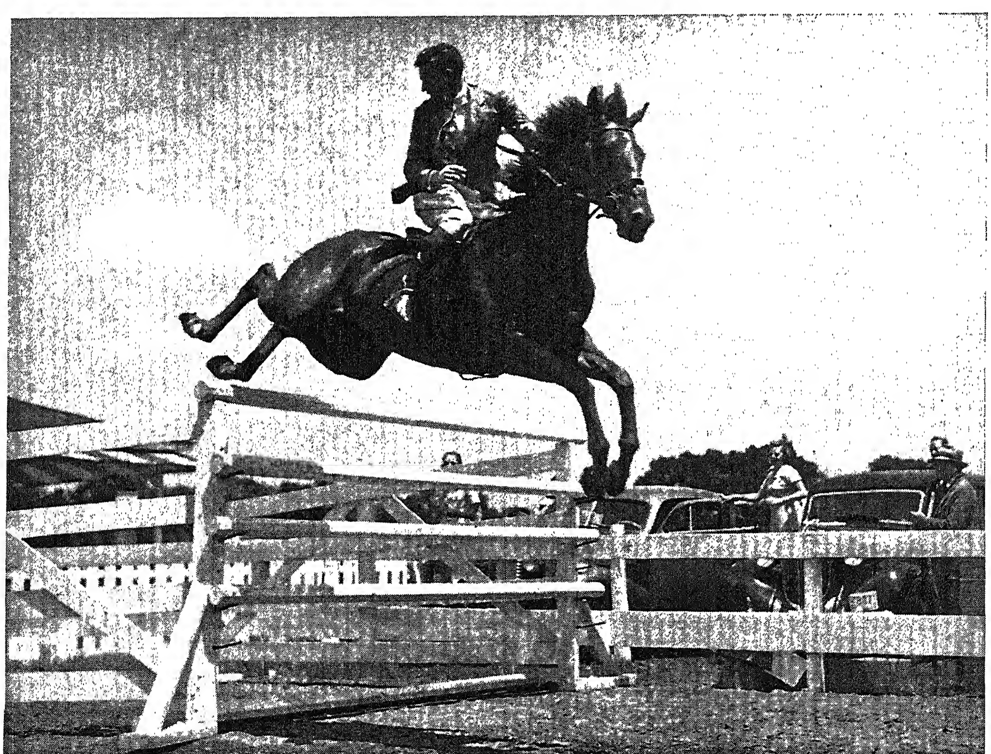
I can't really stress the importance of good pictures as the best salesmen that American Airlines and the aviation industry have today. The best salesman, no matter how glib his tongue, cannot describe the beauties of the sun rising over the Arizona desert, as seen by passengers every morning on the "Flagship" Skysleeper, "The Mercury." A color picture can capture the beauty of that scene and make it available to the eyes of millions.

As a publicity man I can conclude this description by saying that I am a firm believer in the old adage:

"One picture is worth a thousand words."

Publicity Photography As A Profession

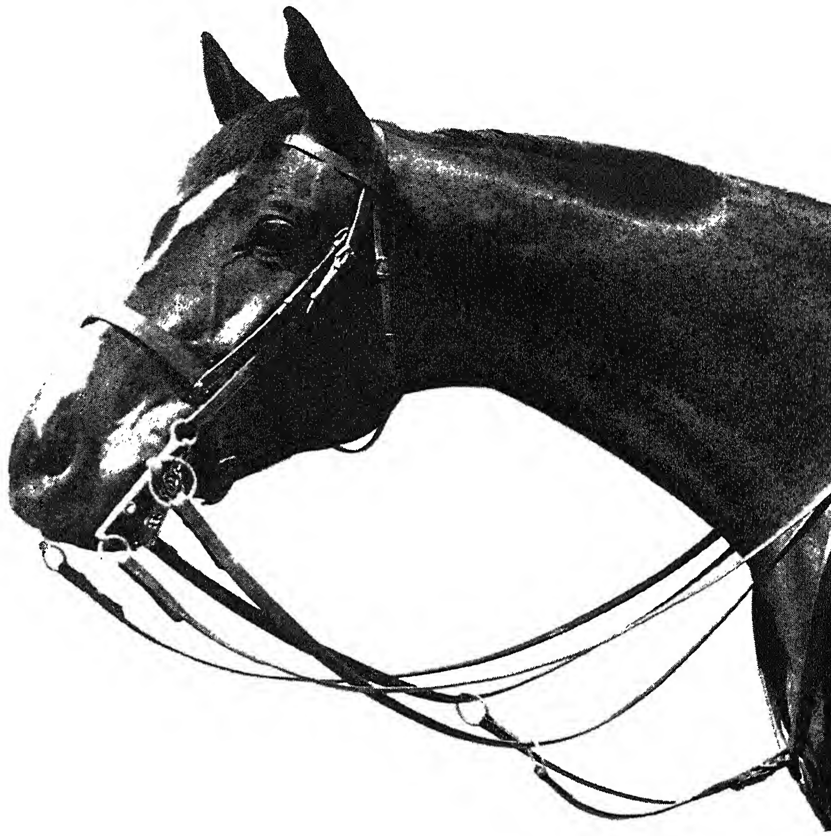
This important field of publicity photography can use photographers who are equipped technically as well as mentally. A photographer in this field without a creative ability of his own is handicapped at the start. As already mentioned throughout this chapter, publicity pictures must be actually dripping with reader interest and editorial attention-getting value. The photographer can be the greatest factor in producing such pictures when he is qualified. Those who are interested can start out in a small way and apply some of the principles discussed in this book, and then absorb all the background information possible from the local account executive or public relations director. There is a chance for many new photographers to make a good living in publicity photography work.



1. A splendid example of action and jumping plus excellent camera timing. Note how the rear hoof of the horse is just clearing the five foot hurdle. Photo by Carl Klein.

FOLLOWING THE HORSES WITH A CAMERA

CARL KLEIN



2. THE HEAD OF A HUNTER.

The photographer of horses must keep a keen eye open for all the synchronized action of a horse. He must trip his camera shutter at the instant when a horse's feet, ears, and even tail are in the exact position required by judges and critical owners. When it comes to watching for the proper leg action it is essential that the photographer know something about horses.

You can make four main types of photographs covering the following horse classifications:

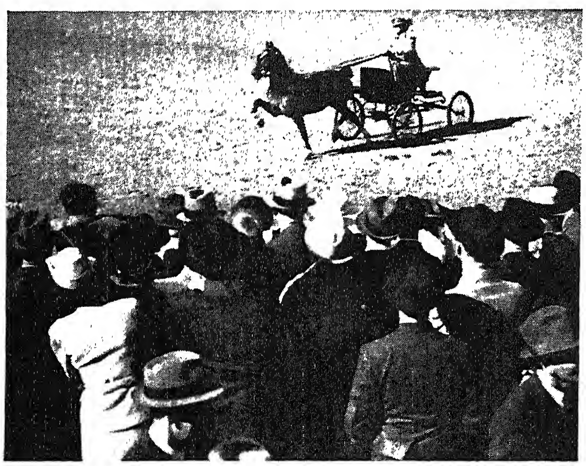
1. The jumper
2. The hunter
3. The saddle horse
4. The harness horse

There are two types of saddle horses: the 3-gaited and the 5-gaited. The 3 gaits are the walk, the trot, and the canter, while the other two include the slow gait and the rack or fast gait. However, the photographer is mainly concerned with the trot because a horse is at his best during this action. The legs are coordinated and off the ground in their proper positions. On the contrary, when a horse is walking his feet look all stretched out and the resulting photographs are not as pleasing as when he is trotting. Thus the saddle horse is shown to his greatest advantage and at the same time emphasizing his most graceful movements.

Usually a trotting horse with one of his forelegs raised produces one of the best types of pictures. When a horse is standing, an assistant can be used for attracting a horse's attention. Just when the photographer is ready to make the exposure, his assistant can make a slight noise or warning which will make the horse pick up his ears and thus create more animation in the picture.

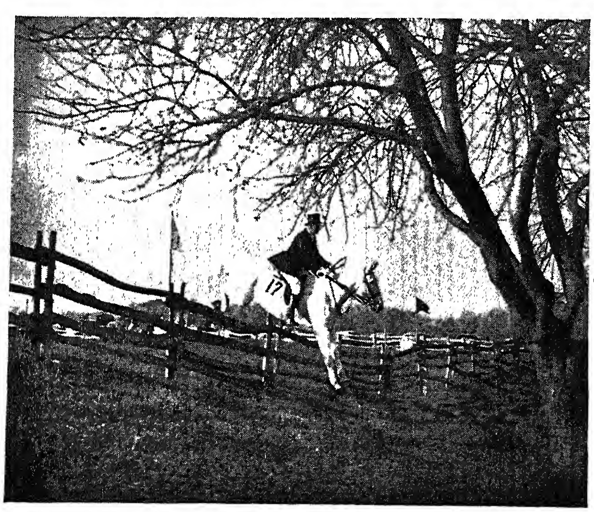
All photographs by Carl Klein

3. THE SINGLE HARNESS HORSE. The harness horse or pony must be shown "stepping high," either with or without a vehicle.



4. HARNESS PONY, with audience in foreground. The picture gives added interest and the placement of the event.

5. THE HUNTER TRIALS. These hunters must perform over fences in field meets or for cross country contests.



Also watch to make certain that the horse's head is photographed at the right height in relation to his body.

The photography of horses is a very exacting one. You should not expect to produce a perfect negative with every exposure.

There are other little details which can detract from the finished photograph; for example, a confusing background can create havoc with the graceful movements of a horse. Avoid having a flag pole sticking out of a horse's nose or some other distracting background object. Also pay attention to the man's, or woman's, riding habit. See that riding clothes are arranged properly.

While the preceding comments cover the main principles and requirements for photographing saddle horses, most of them can also be applied to the jumpers and in some cases, the harness horses.

The jumpers perform in the show ring where every small point counts for or against them. The average jump is from 3 feet 6 inches to 4 feet at these horse shows. On the other hand, the hunter is also a jumper in the field where style is all-important. Of course, the condition and manners of a horse are likewise important in every class. A horse may be easy or hard to handle. These hunters and jumpers must perform over fences in outdoor field meets or for cross country contests.

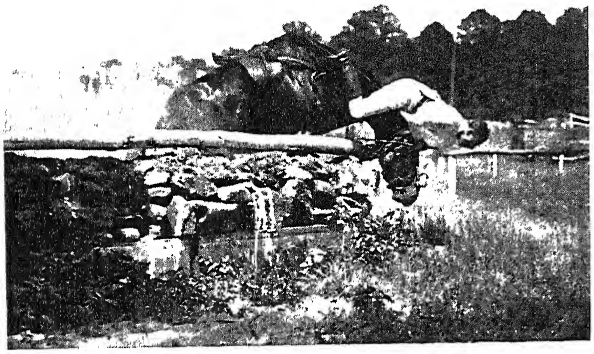
The harness horse may be photographed with and without a vehicle. These horses must be shown in a similar way to a saddle horse; however, one of the main differences is that the harness horse or pony must be shown with his legs still higher. Usually the harness horse is shown single but there are many well-matched pairs which give an opportunity for fine pictures. There are also pairs of jumpers and hunters.

The four horses used in making up a four-in-hand or the road coach, which is the later designation, always make interesting photographs. In photographing these horses I always try to get the teams pulling correctly with their ears and legs in an advantageous position. Make as many exposures as possible; in fact, get the driver to go past your camera as often as he has patience. Possibly three or half a dozen exposures should be made in order to have a better chance in obtaining just the right coordination through the horses. Sometimes a position a little below eye-level gives a slightly more dramatic appearance to the final picture.

The Actual Photographic Technique

Aside from having a thorough knowledge of horses and what to anticipate, it is very essential that the photographer know his camera as well. I use a Speed Graphic with the direct wire view finder. This gives me an opportunity to watch all the action take place. I must stop action at the instant when I see it at its best while looking through this wire finder. For example, when I

6. THE SADDLE HORSE. Usually a trotting horse with one of his forelegs raised produces one of the best types of pictures. So remember to watch for the leg motion and wherever possible get this action coordinated with the ears in the proper position and also the tail in its most advantageous position. Likewise, the head of the horse must be photographed at the right height in relation to its body.

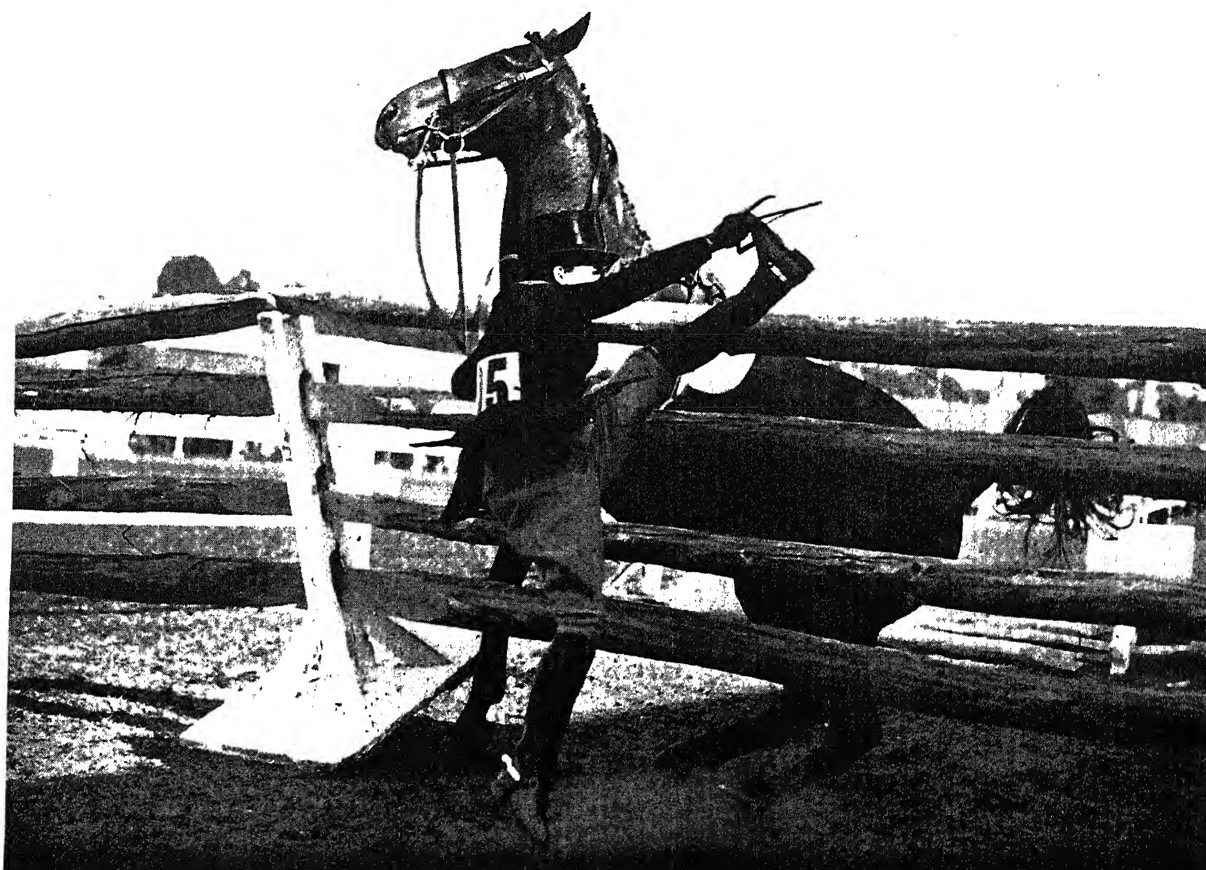


7. This jumper didn't get over the hurdle but Carl Klein stopped the action at about 1/750 second.

am photographing a jumper I usually take a position 25 feet to 35 feet away from the jump. I hardly ever take a position at a direct 90 degree angle from the horse. I find that the best view comes with a 45 degree position in order to get a better separation of the legs and also the two ears. A straight side view often shows only one ear and sometimes even the legs do not look good because there is no separation which comes with the three-quarter front view.

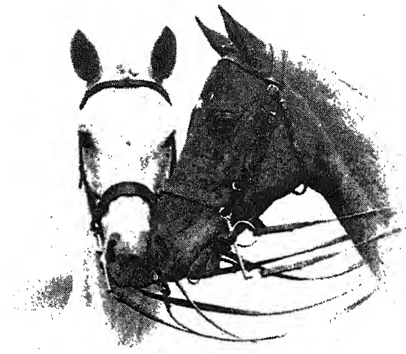
I always use the fastest film I can obtain. This may be the Agfa Super Pan Press, the Eastman Super Panchro Press film, or the Eastman Super XX. The same is true with my speeds on the Speed Graphic Camera . . . I always use the top speeds depending upon the specific

8. TWO JUMPERS. An excellent action photograph taken at the top speed of about 1/750 second, f/8, Fast Pan film. Such pictures are the interesting variations which come in the normal course of events while photographing horses.



conditions. If the weather is cloudy or if the photograph is made late in the day I naturally must use a slightly slower speed. However, as an average I would say that all my exposures are made between f:6.3 and f:8 at about 1/750 second during the summer months here in the New York territory.

Of course, there are many other related subjects to be taken in addition to the standard types already mentioned. For example, the young colts always make interesting and humorous pictures showing their awkward and gangling motions. Then there will be closeups of the cup and ribbon winners or possibly team groups, and closeups of the heads of all the previously mentioned horses. These angles enter into the background of the main events.



9. Two hunters get into a huddle in this closeup portrait.

10. THE ROAD COACH. When photographing the four-in-hand, or the road coach, I always try to get the teams pulling correctly with their ears and legs in an advantageous position. Sometimes a position a little below eye level gives a slightly more dramatic appearance to the picture. All photos by Carl Klein.

1. MARTHA GRAHAM — EKSTASIS. In this dance, the love theme is expressed through the rhythmical torso, flowing curves and fine tensions. The surrounding space gives a curved airy depth for the sculptural clarity of the figure. Back and side lighting used. 1/50 second, f:16, **Fast Pan film.**

PHOTOGRAPHING THE DANCE

BARBARA MORGAN

Speed of the dancing body moved by human nerves and muscles. . . .

Greater speed of modern lenses correlating with fast film emulsions . . . receptive to the incredible speed of light. . . .

Only in the last few years have dance photographers had such wonderful equipment for working partners as to be able to capture the most fleeting expressions of movement. Today's cameras and fast films make dance action photography possible — but stopping action mechanically means nothing. Speed in the raw means nothing. Often finer overtones of emotion and imagination are transmitted by relatively slow dance gestures and camera shutters. But whatever the speed gamut of the dance, it is now possible to express with modern cameras the vitality and rhythmical poetry of dance.

Absorbing the Dance

As I want to make a work of photographic art, which at the same time expresses the art of the dance, I approach my job as follows:

I attend rehearsals and performances, absorbing the spirit of the dance to be photographed. The general progression scheme, tempo, the positions on the stage, and style of movement and gesture are of first importance. Rhythm and color of music accompanying movement help fix the images in my memory.

Choosing the Significant Gesture

Most dances can be boiled down to the three or four most significant gestures which people spontaneously remember. Gestures which persist in my memory are those worth developing into pictures. Dance is continuous in time and space. Spectators see dance as a unity. The climactic movements and attitudes appropriate for still photography can be chosen from that unfolding series of movement. The significant instant selected must have the very essence of the dance. The photographer must somehow give the life of that instant and also—to have flow and continuity — must create an illusion of what has preceded and is at the moment unfolding.

Having absorbed the dance as much as possible beforehand, I drop it into the sub-cellar of the subconscious and get busy with the preparation of the studio and cameras.

Environment for Dance Photography

To create the power, delicacy, excitement of the dance —there must be the most exacting preparation of equipment. The floor space must be danceable — the background must permit versatile lighting treatment. Cameras, lights, and film must all be selected for maximum results—of speed, depth of field, definition and plastic rendering.

The question might arise, "Why not work out of doors?" For certain dances, the out-of-doors is a suitable background, just as the plaza is right for the Pueblo Indian dances. But modern dance is, so far, definitely of the theater where controllable space and lighting make highly organized design possible. Trees, bushes, rocks, and bumps are distractions from the essential clear statement of movement. For my work, I believe in an indoor photographic theater, as spacious and well-lit as finances permit.

Cameras

The need for speed, depth of field and ease of handling puts great demands on the camera. I use various cameras for specific jobs; but I find that the Speed Graphic equipped with the Kalart Lens-Coupled Range Finder and the Parallax View Finder for close ups is the camera with which I do the bulk of work. The 3¼ x 4¼ or 4 x 5 yield large enough negatives to give good definition in an enlargement. The focal plane shutter goes up to 1/1000 second, which is ample for dance action as even 1/550 will catch most leaps, turns and falls. The f:3.5 Zeiss Tessar gives me, with my lights, a working range on solo figures averaging 1/100 at f:8.

If I want to stop down for greater depth of field and at the same time have greater speed, I find that the Speed Graphic is more reliable for flash adapting than other cameras I have used. It is light enough to hold in the hand, so that I do not have to bother with a tripod which hampers much action. Often I keep a 4 x 5 camera on a tripod and a 3¼ x 4¼ free in my hand and repeat the same movement, getting different interpretations from each. Whenever an action is slow enough and formal enough, I like to use a tripod for added

stability and resulting definition. But if its use in any way stops the free flow of the dancer's mood, I work with a hand-held camera. To stop and mount a camera is very distracting to the dancer. I like everything laid out so that I call as little attention to gadgets and manipulations as possible and I try to be as familiar and unconscious of equipment as is safe. In this way my eyes are free to encourage the mood of the dancer and watch for a minute clue that may lead me to some composition which I did not expect.

Film and Development

I have used principally Agfa Superpan Press and Eastman Super Panchro Press with a Weston rating of 64 under artificial light. Now I am experimenting with Eastman Tri-X and Agfa Triple S with favorable results. All of these films I develop in Harvey Panthermic 777 to a gamma of .8 or .9. This fine grain developer, with its energy kept constant by the replenisher system, gives me negatives which can be enlarged to great size. In my dance photograph exhibits which are booked in many colleges and art museums over the United States I use many 16 x 20 pictures to give large scale swing and movement. As often only a part of the negative must be blown up, I am able to make such enlargements from this development.

Lights, Background, Floor

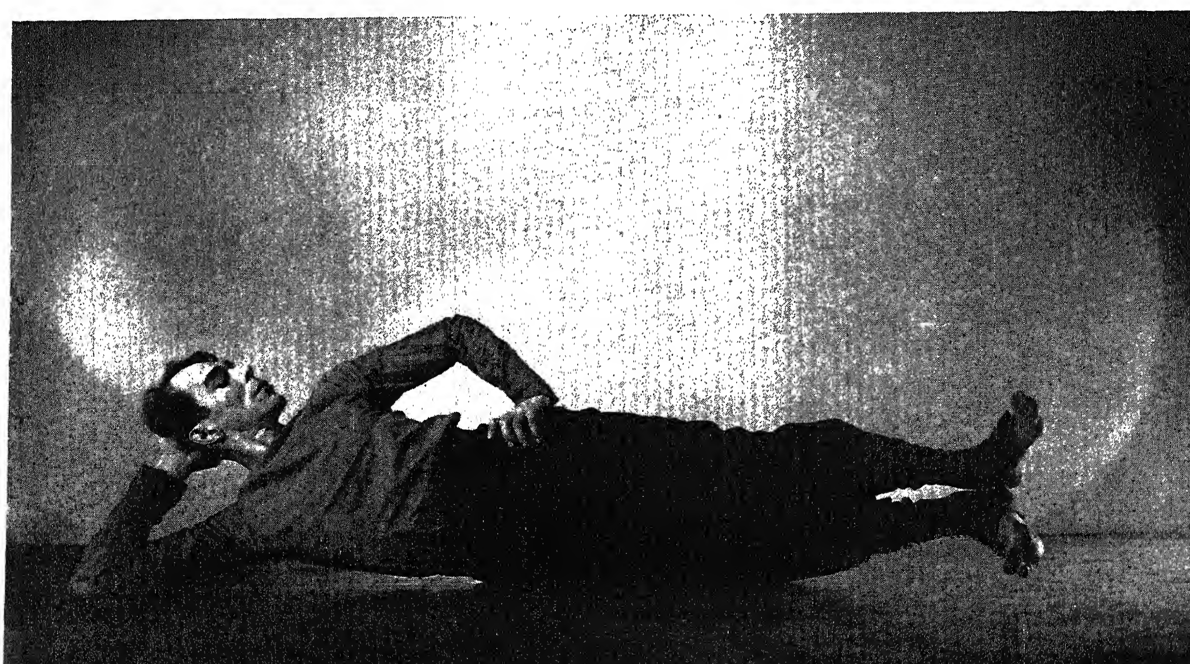
Lights, comprising floods and spots, plug into a spider box at rear right of the general working center. Extra long cables from the lights make it possible to spread them back, out of the way, so that we don't trip over them . . . much. The background is white so that it can be rendered white in the picture by close illumination . . . gray by less intense illumination . . . or black by no illumination. The floor covering is brown battleship linoleum which gives a firm resilient floor for dancers' footwork.

Dancers' Preparation

All actual preparation of cameras, checking and placement of lights, and film loading have been carefully attended to before the dancers arrived, but to put the dancers at ease I sometimes go through the motions of working while they get ready.

Coming into the studio from the street, the dancers begin to shed the everyday world and work into character as, by degrees, they prepare themselves. Costumes are best freshly pressed if they are at all wrinkled from the suitcase. The makeup kit is laid out, and they start patting on the cold cream.

Makeup is a subject by itself—but regular panchromatic makeup gives a clear rendering of the face. Accenting of eyes, eyebrows, lips or other features must proceed from the character of the dance. Makeup for movement is not the same as for still portraiture. When the final interest is the whole body in motion, the head and features must be treated in relation to the total de-



2. CHARLES WEIDMAN — DEATH OF GRANDFATHER HOFFMAN from the Suite "On My Mother's Side." In this playful satire on his ancestors, Weidman portrays his grandfather who wouldn't relax — even in death. Treating his feet as the escaping wings of the departing soul, I sent a cradle of light down from heaven into his head and up through his feet. Medium wide angle lens used to increase horizontal effect. Spotlight on his head and chest. The rims of two floodlights make the cradle . . . also touch up the toes. Care was taken to illuminate under the body from the hip to elbow to exaggerate the rigidity of figure.

3. DORIS HUMPHREY — WALTZ FROM SQUARE DANCE FOR MODERNS. Transparency and the play of shadow were used as an accompaniment to the lyric movement. A 1000-watt spot was focused to a small diameter at the position where the head and arm would be at the right moment of the leap. This light carried obliquely through to the background and cast the descending shadow form. General illumination from floods. 4 x 5 Speed Graphic, 1/825, f:4.5, Fast Pan film.

sign. If action is fast, the eye length may be extended somewhat at the corners, the eyebrows prolonged, the mouth increased, in order to register. In slower poses a portrait makeup is best unless some bizarre effect is part of the portrayal. The powder base should not be heavy and greasy as strenuous exercise under the lights brings out beads and streams of perspiration. A light foundation cream patted on uniformly in a very thin film looks natural rather than caky, is entirely comfortable and does not have to be retouched during work except for occasional repowdering. An assistant is on hand at such times with powder puff, kleenex, comb, and mirror. Flowing hair should be brushed before each camera appearance, especially if it has become tangled from the previous action. An elaborate coiffure must be rearranged if motion has spoiled it. If male and female dancers are to be photographed together, the man should make up slightly darker.

Beginning to Shoot

Now the dancer steps out in costume beginning to feel the character and the dance. We stop talking and quiet down while the dancer warms up with exercises and excerpts from the dance. Meanwhile I play the lights into a starting position, and click the shutters of the cameras; noticing that the lens shades are firmly adjusted, that the exposure meter and loaded film holders are handy and in order. With one camera mounted on the tripod and another at hand, we are all set.

The dancer is no longer a person but has become a sensitive instrument. I ask the dancer to sketch through the dance so that I may get the feel of the whole design while following it through the camera view finder. I pick out certain passages — we go over them — perhaps exchange a few words on interpretation. Then I single out one composition. In order not to exhaust the dancer needlessly, I have taught myself to compose and light the picture mentally as much as possible. Even so, I must ask the dancer to perform, repeat with slight variations, repeat for lighting, focusing, composition on the floor, etc. When this involves violent action, as it often does, it is indeed a strenuous job. But every dancer I have worked with has been untiringly and wonderfully cooperative.

4. CHARLES WEIDMAN WITH JOSE LIMON AND WILLIAM ARCHIBALD IN "TRADITION." In this satiric dance, tradition is dying and having to be bolstered up. Plastic build-up of forms is increased by the perspective. Limon, kept dark and large in the foreground, balances the two receding and lighter figures. The whole picture is built on obliques, both of strength and of collapse. Back lighting from the right side lifts the arms and legs clear of the floor and weaves an oblique shadow across the foreground. A high front spotlight picks out Weidman with his halo of toes and gives secondary lighting over the supporting figure. Medium wide angle lens, ½ second, f:16, Fast Pan film.

5. DORIS HUMPHREY AS THE MATRIARCH in "With my Red Fires." 4 x 5 Speed Graphic, 1/440 second, f:6.3, Fast Pan film.

Anna Sokolow (after such a session) said that she felt as if she had given a concert. I try to keep the working atmosphere at concert pitch, as much as possible; the atmosphere of dancing rather than of posing. Sometimes we quickly settle into a working rhythm. I can tell when a dancer is really lost in the dance—the eyes relax into a far-away focus. When the dancer is still concerned over a costume detail, or is conscious of me or the camera, focus of the eyes is close and specific. No picture can be worth clicking until that eye focus has eased off. However, to break the ice and give assurance, I often click a few negatives which I know will be worthless, except as they have helped the dancer to warm into a working confidence.

Designing and Shooting

Let us photograph Doris Humphrey as the Matriarch from "Red Fires." The Matriarch tries to possess her son against his beloved. In the climactic moment of this dance role she whirls triumphantly in a flowing circular skirt. To go into this movement, she must have a take-off of rhythmical running steps climaxing in the whirl. We rehearse the action, noting the floor position for the take-off, counting the number of intervening steps and the point on the floor where the whirl takes place. On this point I focus, also taking into account the depth of field. To keep the body sharp but to have the outer whirl of the skirt go fluid, I plan to give a shutter speed of 1/440. With the lights on, the Weston Meter shows that an aperture of f:6.3 is needed. For the single figure there will be ample depth of field. If there had been more than one figure necessitating greater depth of field, one way to gain depth would be to add flashlights to the lights in order that the lens might be stopped down.

Design

Design of the action is based on the spiral of the skirt opposed to the vertical shaft of the body and the outstretched horizontal of the arms. The meeting line of the floor and background repeat the horizontal theme of the arms and is used to throw them into expressive relief. The triumphant set of the head on the neck crowns the

inverted vortex of this kinetic pattern. Lighting must illuminate the figure enough to set off whirl from background, but a moody landscape must suggest the sweep of morbid emotions. To unify figure and background, I sweep a light and shadow pattern across the floor and upon the background echoing the spiral of the action. Staccato nodes of white in the face and fists give final binding tension to the design.

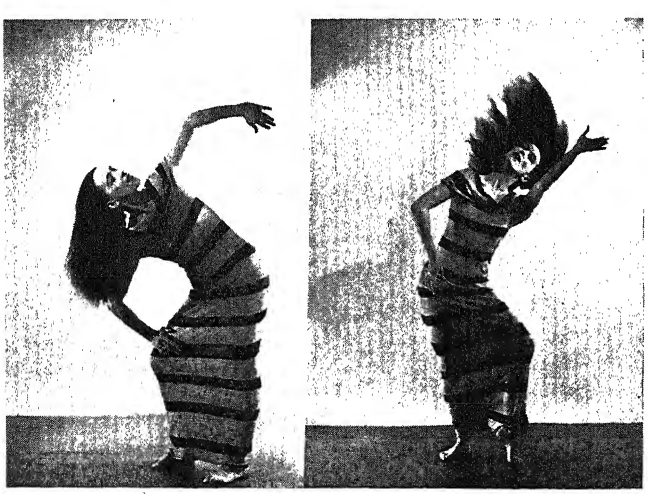
Rhythmic Energy and Space

Every dancer and every dance demand experiment and a special approach. A solo figure in the picture space is the energy center of the design. Swinging torso . . . curving wrist . . . kicking leg . . . subtly inclined head; each form and movement set up waves of rhythmic energy in surrounding space. How space surrounding the figure influences perception of movement, how to provide space to run into, to whirl into, to bow into, to fall into, space which will press in upon and engulf, space which will open and free the figure—such are the endless problems of kinetic design. Any space which does not respond to a trajectory of the figure's movements is dead space and must be cut away.

The dancer rides on breath and music: The intake of breath—the held breath—the expelled breath; the musical up beat—the peak—the down beat. These things I watch. For the final expression I work and wait for the two most important things:

> Fullest imaginative projection which governs energy and spirit.
>
> Rhythmical correlation of the axes of the body which produce the sculptural and kinetic character of the design.

When the axis through the shoulders, axis through the spine, axis through the hips are expressively coordinated, the extremities of legs and arms follow logically from it, much as architectural details proceed from fundamental blueprint proportions, volumes and directions.



6. MARTHA GRAHAM — SATYRIC FESTIVAL. 3¼ x 4¼ Speed Graphic, 1/440 second, f:4.5, Fast Pan film.

America Dances — What to Photograph — Briefly How

Modern dance has so far been of the greatest inspiration to me but there are so many kinds of dancing in America that photographers of widely different tastes may be interested to experiment with varied forms of dance movement and the poetry that arises from it.

MODERN

Modern dance as created and danced by Martha Graham, Doris Humphrey, Charles Weidman, Hanya Holm, Anna Sokolow, and others, is descended from Isadora Duncan and comes forward in a free and democratic spirit. It has a great following all over the United States, especially among college students who feel in its original themes, structure and intensity a natural expression of life today.

BALLET

Ballet was created from the milieu of European court life and is today more of a divertissement than an expressive form. It has charm and lends itself readily to photography, because the dance positions are very predictable. Being of the theater, it is best photographed on a stage or under equivalent conditions in the studio.

COUNTRY DANCES, COWBOY DANCES, SQUARE DANCES

> "Oh, Suzannah, you are the girl for me,
> 'I'm goin' to Californaiya
> With a banjo on my knee."

All over the country, people are finding that square dancing is fun. Happy dancers, young and old, responding to the picturesque caller in varied sets—is inviting "folky" subject matter. Danced out of doors, in barns and big halls, it usually needs to be multiple flashed, as such places do not ordinarily have enough lights.

FOLK DANCES FROM OVERSEAS CULTURES

All the peoples of America save the Indians are from races overflowing from other continents, bringing their beloved songs and dances with them. It is easy to find genuine folk dances danced with gusto in traditional costume, in many rural communities and racial districts within cities. Again, flashbulbs are usually the best way to photograph in these halls or public squares where folk festivals are ordinarily held. Flashing permits stopping down the lens, which in turn gives the depth of focus necessary to take in deep crowds in movement.

7. MARTHA GRAHAM — DEEP SONG. This photograph was taken in a theater with my 3¼ x 4¼ Speed Graphic resting on the apron of the stage while I was down in the orchestra pit. This is a tragic dance about Spain, giving a kind of suspense between life and death. Therefore, the white horizontal line with the reflections below it and the disconnected vertical gray arm and white hand lay the foundation for this feeling.

A high spotlight from the left, illuminates the head into an off-center pivotal intensity, while right-hand floods build up a sculptural crescendo in the rising angles of the legs. Dark blue curtains register black and partly absorb the arms as if to swallow the figure. 1/100 second, f:8, Fast Pan film.

American Negro Dancing

Most of modern social dancing comes from the exuberant inventive dance genius of Negro dancers. Cake Walk, to Black Bottom, to Boogie Woogie, the rhythmical improvisation, loose jointed abandonment, syncopation, sex excitement make it colorful subject matter, which is best flashed to keep the whole atmosphere natural and gay.

Dance of Musical Comedy

VAUDEVILLE, NIGHT CLUBS, STRIP TEASE, etc.

Candid camera fiends have long hunted on these preserves. For more ambitious photographers, such photography can be done on the stage, or under stage conditions to best advantage, with flash thrown into it when necessary. Tap dancing of Astaire and Rogers, and Paul Draper can only be done justice to with sound movies.

SOCIAL DANCING — WALTZ, FOXTROT, TANGO, LAMBETH WALK, SHAG, JITTERBUG, SWING, etc.

Shot from the documentary angle of how people dance for a good time or handsome compositions from exhibition couples, it is ordinarily most convenient to multiple flash.

Southwest Indian Dances

Zuni Rain dances, Hopi Snake dances, the Corn Dance of San Domingo Pueblo, and the Yeibichai of the Navajos—these magnificent American dances stir one to the roots. Dance welds the tribe into unity to pray for rain, to celebrate birth, puberty, marriage, to lament death, to give thanks for fertility of the corn, to propitiate gods and evil spirits. Their communal life cycle is danced.

8. JOSE LIMON — INDIAN FROM "MEXICAN" SUITE. Living freely between the earth and sky I make the Indian a plastic dark center, radiating movement into many directions. Lighting the shoulders and nose strongly, implants the figure downward into the earth . . . and darkening the up-stretching arm and fist, claims the sky. The arms are like propellers in relation to the horizon line and the shadow of the leg gives a suggestion of rotation. The convex chest curves back into the extended leg which is held dark to keep a clear rear oblique position. Back lighting with floods, spotlighting on shoulders. 4 x 5 Speed Graphic, 1/350 second, f:6.3, Fast Pan film.

But—it may not be photographed. The Indians resent the intrusion of photographic pests. In a few places you can pay $5 or $10 to shoot from the sidelines, but even so such pictures are furtive and fragmentary. To be right it should be done seriously with the cooperation of the Indian Tribes and the government to preserve these dances as Indian Art. I wish that some day I might do this.

Finale

And so . . . whether the photographer is after the direct overflow of the animal spirits and conviviality of the folk dance or the deep and more complex beauty of an individual choreographer-performer, there is great satisfaction in trying to capture and preserve these ecstatic states.

As such, dance is a barometer of the vitality of a people; and to the social historian the dance of a time, place, and people is important and revealing. To the artist it is a joy in itself. The photographer is the modern image-maker. As such I am happy to be releasing images of vitality through photography which I believe is the perfect medium to express dance. It automatically fuses sculpture, space architecture, drama, and musical timing which are the components of dance. In no sense does photography imitate any of these; but rather, this most modern of the arts has inherently these expressive qualities, plus unique and valuable characteristics of its own. The power to seize at the most living instant of combustion the energies of mind and body revealed in the dance and render them so authentically that they are welcomed as true both to the spirit and the letter, such is the magic possible to photography.

9. MARTHA GRAHAM — FRONTIER. American pioneer spirit going west. Composition and lighting further the gesture of a constancy and horizontal launching. 3¼ x 4¼ Speed Graphic, 1/100 second, f:6.3, Fast Pan film.

1. Oblique photograph of Rockaway Beach, New York.
2. Boats in the Kill van Kull Channel, Staten Island, New York.
3. New York City, showing lower Manhattan in the foreground.
4. The American Airliner gives added interest and also greater depth to this photograph showing the Statue of Liberty in New York Harbor.
5. This view of the Philadelphia Navy Yard presents an interesting air photo pattern.
6. Another striking aerial view showing an oil refinery in South Chicago.

All photographs courtesy American Airlines.

AERIAL PHOTOGRAPHY

WILLARD D. MORGAN

Aerial pictures give us the opportunity of seeing familiar ground objects from an entirely different viewpoint. The aerial picture looks down on the surface of the earth. Objects take on an entirely different perspective and relation to each other. While the eye can take in many square miles of aerial territory, it remains for the camera to adequately record every minute detail in this area. Thus the camera quickly records what the eye cannot see, because the airplane moves steadily on and new vistas appear constantly.

The aerial photograph differs from the ground type of picture by having no foreground objects, except for possibly a wing tip or a passing cloud. Otherwise, the distance between the camera and the aerial photograph on the ground may vary from a few hundred feet to thousands of feet.

The United States is the only country in the world which permits such a free use of the camera in the air during peace times. Photographs can be made by anyone, in any place, with only a few exceptions where military areas are involved. This freedom of aerial photographic possibilities has been a great stimulus to the production of many fine aerial views. Also, the progress and interest in aerial photography are greater in this country than anywhere else in the world.

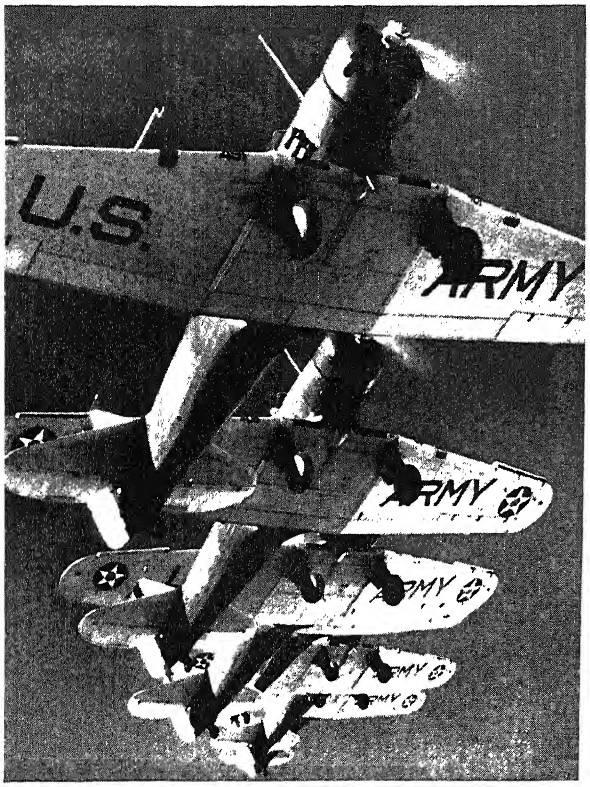
Over twenty years ago, the aerial picture was mainly a war necessity. Then the commercial angle in aerial work developed successfully, while today the third stage is the widespread development among private photographers and amateurs. In this latter case it is possible to produce aerial photographs which can successfully be compared to some of the best commercial aerial views.

Some of the commercial and private applications of aerial photography cover many different subjects: the real-estate owner can use aerial pictures to help plot and sell his property; surveying expeditions may save many months of work through the use of the aerial picture: this includes the extensive coast and inland surveys carried on by the government. Other applications cover the photographs of factories, estates, geological surveys, legal condemnation and zoning pictures, city planning, and timber cruising. Many archaeological expeditions have used the aerial camera wherever important exploration work was to be found. Then we find the aerial picture used for studying city planning, traffic regulations, forestry surveys, and especially the news picture, which may cover a flood or a local fire, and editorially scenic views.

The actual making of aerial photographs is really a very simple operation. The camera lens, shutter, and focus can be set for practically one fixed position. All aerial pictures are taken with the focus set at infinity. The shutter speed is usually set for about 1/100 second up to 1/500 second with a diaphragm stop of approximately f:8 to f:16 depending upon the film or filter used and the condition of the daylight. With the work simplified to this extent, the camera user has very few things to think about. He can concentrate on selecting interesting ground objects as the plane flies along.

As the great majority of photographers will be interested in making aerial pictures for their own pleasure rather than for possible commercial purposes, we believe that more emphasis can be given to the interpretation of aerial pictures. An aerial view can really become a very interesting and exciting subject. With a little practice we can soon learn to read the aerial photograph just as we read an ordinary road map. However, the air picture goes much farther and shows every bit of ground detail, while the map is only the skeleton of the same area. It is always advisable to have road maps to supplement the territory you have photographed from the air.

Let us take a few of these aerial pictures and see what they can reveal. Such air pictures will show you the general terrain of the country . . . the direction and forms of rivers and streams, their size and the country through which they go. Great patchwork quilts of fields will find you figuring out the type of crops, the plowed field, the swamp land versus the good agricultural land. Soil erosion results show up in the aerial pictures like gapping arteries. You will find winding roads going over small wooden bridges or leading through rolling hills to cement roads and then on over a large modern iron bridge. Cities, canals, turbulent waterfalls, forest fires, and possibly the more intimate closeup of a typical farm yard will all make fascinating photographs. As all these details could not be placed on the ordinary map,



7. This excellent photograph comes from the U. S. Army Photographic Division at Randolph Field, Texas. The planes were at an altitude of 4,000 feet and 500 feet above white clouds . . . giving interesting reflected light in combination with the back lighting of the sun.

your aerial picture will thus be an important addition for the later study of any particular territory you have covered. Thus the whole subject and the methods of aerial picture reading and understanding should be developed by everyone. Even the non-fliers will find an absorbing study in the aerial picture. Start your own collection of pictures. Cut them out of the magazines and roto sections of your papers. Then when the opportunity does come for you to photograph from the air, make as many pictures as you can add to your aerial picture collection.

Possibly you might be interested in forming a picture collection covering one city. You may collect such pictures as will show the city planning layouts, the roads leading to the business center, the parks, the railroads, and many other important subjects. These pictures can later be supplemented with ground views when you have the opportunity to visit any of the cities.

Still another collection might show all the various agricultural crops from the air: a corn field, orange grove, wheat fields, celery acres, alfalfa fields and many others. Then there are the rivers, bridges, forests, mountain ranges, closeup views of typical building developments, dams and irrigation projects, railroad yards and their connecting lines, airports, and other earth forms of equal interest.

You can compile an aerial collection of pictures to show the geography in your own locality. Here is where you will have fun pointing out the location of your own home or the homes of your friends, roads, streams, trails, and other familiar ground features.

Try making progressive construction photographs from the air of a dam, new highway intersection, building, or any other project. Then mount the picture series in your album in an attractive layout. Chances are that you might sell these sets to the contractors or others interested in the job.

How To Make Aerial Pictures

We are all familiar with the two types of aerial pictures: the vertical and the oblique. Another type is the stereoscopic aerial picture, which is used mainly for military purposes and is an adaptation of the vertical view. However, two pictures are taken at fixed intervals for the final stereo view. In our work, however, we are mainly concerned with the vertical and oblique pictures.

The vertical aerial photograph is made with the camera pointed directly down towards the earth. Such pictures can only be made by holding the camera out of a window, or pointing it through an opening in the floor of the plane itself. The vertical picture does not produce such an interesting or pictorial view as the oblique picture. By looking straight down at objects it is quite difficult to get any idea about their appearance. However, the vertical picture does give the comparative scale and exact size of objects with their relation to each other.

The oblique aerial photograph, on the other hand, is easily made by pointing the camera through a window of the traveling plane. Such pictures will show the relief and the characteristics of the ground from different angles. These angles may vary between thirty and sixty degrees. Usually the average angle is about thirty degrees.

How To Start

First of all we need a camera to make our aerial pictures. Either the Graflex or the Speed Graphic models can be used. Possibly the Speed Graphic camera will be favored, because of its ease of operation with the eye level view finder. As there is no problem in focusing, the camera can be set rigidly for infinity focusing. The only thing to concentrate upon is the actual snapping of the picture and the changing of the film. Some photographers have a metal shade which they can place over the Speed Graphic bellows, when a camera is to be used in open cockpit planes, or where it is necessary to hold it outside of a window. However, in the majority of cases, the standard Speed Graphic camera can be used without any alteration, in any regular transport passenger plane or even in private planes where the camera is held just inside of a window to avoid the strong slip-stream suction of air on the outside. In rough

weather metal or lead shot can be tied to the camera to prevent vibration during exposure.

When selecting a photographing position, in either a passenger transport plane or in one of the private planes, try to get a place where the wing or any other construction will be as far out of the angle of view as possible. This may call for a position at the front or back end of the cabin. It is rarely possible to open a glass window in the regular transport planes.

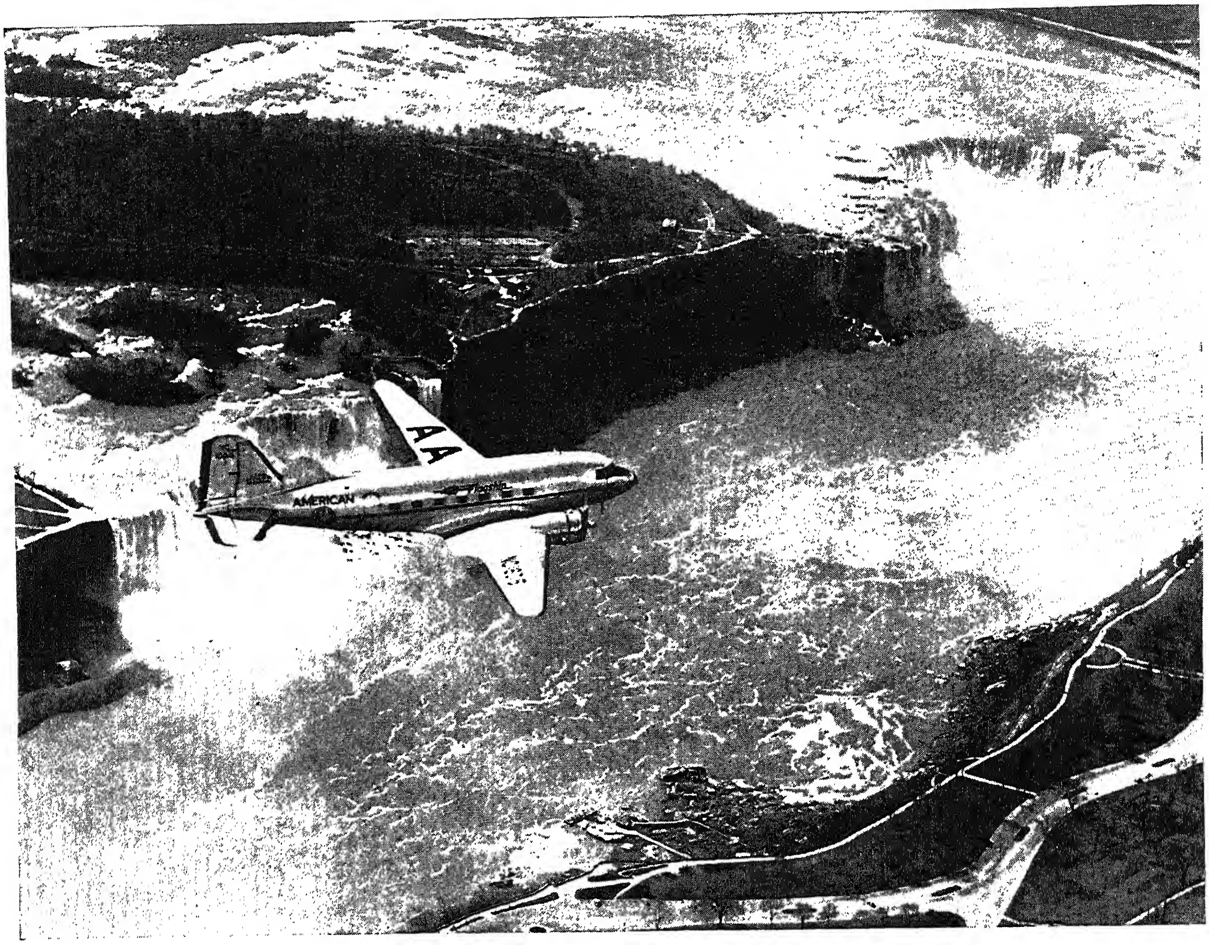
Assuming that the window is clean, the glass itself has practically no effect on the final picture. Therefore, forget about the glass and make your picture just the same. Hold the lens as close to the glass as possible without touching to avoid reflections from other windows. In other types of planes, it may be possible to lower the glass windows, or you can, in some cases, remove the door where special photographic work is to be carried out.

Avoid Camera Vibration

One of the first things to learn in aerial photography is to hold the camera as rigidly as possible, in order to avoid any vibration. It is impossible to use a tripod in the plane because the vibration will be quickly transmitted to the camera and thus spoil the detail in the negative. It is best to sit in your seat and hold the camera at eye level pointing it through the window ready to make the exposure. Keep your elbows clamped tightly to your sides. This will help steady the camera at the same time. Keep the camera lens as close to the window as possible without touching it. In fact, do not let the camera touch any part of the airplane. The constant vibration is practically absorbed through the body. Do not rest elbows or shoulders on plane structure, but sit free in your seat. Then by using a fast shutter speed there is no danger of making blurred or unsharp pictures.

The importance of using the proper shutter speed cannot be over-emphasized. A slow shutter speed of 1/25 second might work if the plane is high enough and

8. FARMERS' SNOW TRACKS IN IOWA. This picture made by a *Des Moines Register & Tribune* photographer tells a magnificent story just by studying the snow trails on this Iowa farm.



9. Niagara Falls with American Airline Flagship in foreground. Merle Oelke, staff photographer of American Airlines, made this photograph with a 4 x 5 Speed Graphic. He states, "Timing is one of the important problems for this type of work. It takes a lot of team work between the pilots. Many times the camera ship is too slow. Whenever possible, we communicate with each other by radio telephone. It is a great help to use the same pilots who have flown for pictures at some previous time."

you are sure that you can hold the camera steady during the exposure. However, it is much better to set the shutter for a faster speed of possibly 1/350 second or better still 1/550 second. These fast speeds are especially recommended when making exposures at low altitudes of a few hundred feet. In such positions the speed of the plane passing over the ground calls for this fast exposure. In such cases it is best to shoot at a three-quarter angle to the front or rear where the object does not pass too quickly.

A lens shade is a necessity to cut out cross reflections from the plane wing or sunlight. Use a shade which can be fastened tightly over the lens. If a metal protective hood is made for the Speed Graphic bellows see that this hood extends beyond the lens for three or four inches, and paint the inside black.

Some photographers advocate the use of an exposure meter for determining aerial exposures, while others say that they cannot use a meter. In some cases a meter might be advisable, but good old personal experience is always to be relied upon. If you have a meter take readings and keep notes to see just how close you come to the correct rating. Avoid the bright reflections from the plane's wing or nearby clouds if a full exposure meter reading is to be taken for the ground detail.

Of course, it is always best to make photographs at low altitudes whenever possible. This can usually be done when flying in private planes. In the first place, you will usually pick a very clear day before going up anyway. At the high altitudes there is always haze to be seen in the air, in fact blue haze starts at 125 feet. In order to cut through this haze a No. 1 or especially a No. 2 yellow filter is recommended. The No. 2 yellow filter would be a good all-around filter. The Aero 1 and 2 filters are also recommended for aerial work. Such filters serve to cut through blue or water haze which really consists of fine particles of water vapor in suspension. The denser the filter, the longer the exposure. When using fast shutter speeds, of 1/200 second or faster, it is sometimes impractical to use the deep yellow

or the red filters, unless there is an abundance of bright sunlight. The denser the filter the more correction will be obtained in the film and the blue skies will be dark on the finished paper print. Of course, the ground details will be given more contrast by use of the filter.

The direction of lighting is quite important. An early morning or late afternoon light will give long shadows, which in some cases produce extremely interesting aerial views. Again, the haze is more noticeable when photographing against the light. If pictures are to be made under such conditions, it may be necessary to use a denser filter and give more exposure.

What Films To Use

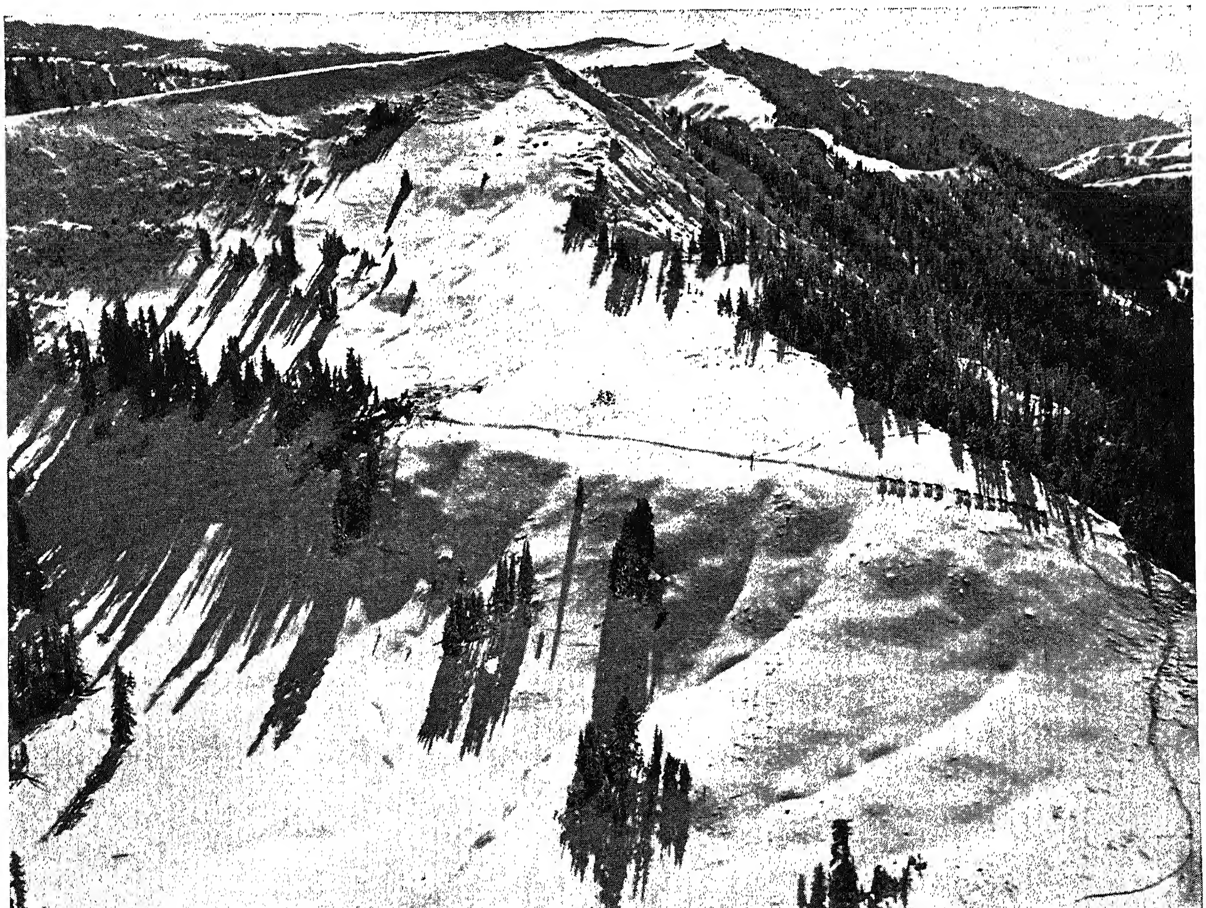
The consideration of films to use in aerial work is of importance. Panchromatic films are essential for this type of work. When using the large film areas of the Speed Graphic and the Graflex Cameras, 2¼ x 3¼ up to 5 x 7 inches, it is possible to use the fastest panchromatic films made and thus provide for fast shutter speeds and also the use of the filter when necessary and at the same time provide fine detail in the negatives. The fast pan films, such as Super XX, Super Panchro Press, Superpan Press, and others are all recommended for this type of work.

Fine grain development is also essential for these films. Such processing will produce some of the finest negatives you have ever seen. Avoid overdevelopment of negatives. A normal brilliant negative is to be preferred over a dense negative which may block up some of the fine ground details of the aerial picture. It is advisable to try out your film on the ground first, in order to learn about its speed and characteristics. This can be done by photographing from the top of a hill or high building.

Infra-Red Photography

With the recent development of infra-red film and plates the possibilities in this field of aerial photography have been increased tremendously. The use of infra-red film is recommended where long-distance shots are to be made. Such pictures may even show the distinct outlines of mountain details which are invisible to the ordinary eye.

Light is scattered by the moisture and dust particles



10. AN AIR CRASH SCENE. This picture by Ralph Forney stands out as one of the great aerial pictures taken in recent times. Forney's plane arrived on the scene just as the pack train of horses rounded the bend of the mountain. The whole story of the crash is dramatically portrayed from the air. 4 x 5 Speed Graphic, 1/235 second, f/16 Fast Pan film, Fall sunlight at 3:30 p.m.

in the air. As a result, the eye sees this condition as a bluish haze. The infra-red emulsion is sensitive to the red or infra-red rays which can penetrate this haze for great distances when a dark red or the full infra-red filter is used. However, at the same time, the other colors, such as ultra-violet, violet, and blue are absorbed by the filter, which must be used over the lens of the camera with the infra-red film. The medium red filters give partial correction and permit fairly fast exposures. Green trees and all types of green foliage reflect infra-red light, and thus make a denser exposure portion on the negative which shows up lighter on the paper print. This is the reason for the "snow effect" often seen in out-of-door pictures made on infra-red emulsion.

As most lenses are not fully corrected for red light, it may be necessary to mark a slight change in focus for using the camera with infra-red film. It is best to have your lens checked by the manufacturer to determine this focusing position. A special mark can be engraved on the focusing scale. Usually such marks are placed slightly forward as compared to the regular scale. The focal change is about 1/200 of the focal length of the lens.

Some Inside Facts of Aerial Photography

Charles H. McLaughlin is a veteran photographer who has been making pictures from the air for over fifteen years, summer and winter, around his home base which is New York City as well as jobs which take him into Canada and even to South America. His equipment consists of a 4 x 5 Speed Graphic which he uses for ground work and a 5 x 7 camera for most of his aerial work. A personal account of his experiences is of first importance. Some of the following information was also used in *The Sportsman Pilot Magazine* by Mr. McLaughlin:

In aerial work everything can be simplified to just three important factors . . . filters, film, and the operator himself.

1. Filters have to do with tone, contrast and the penetration of haze.

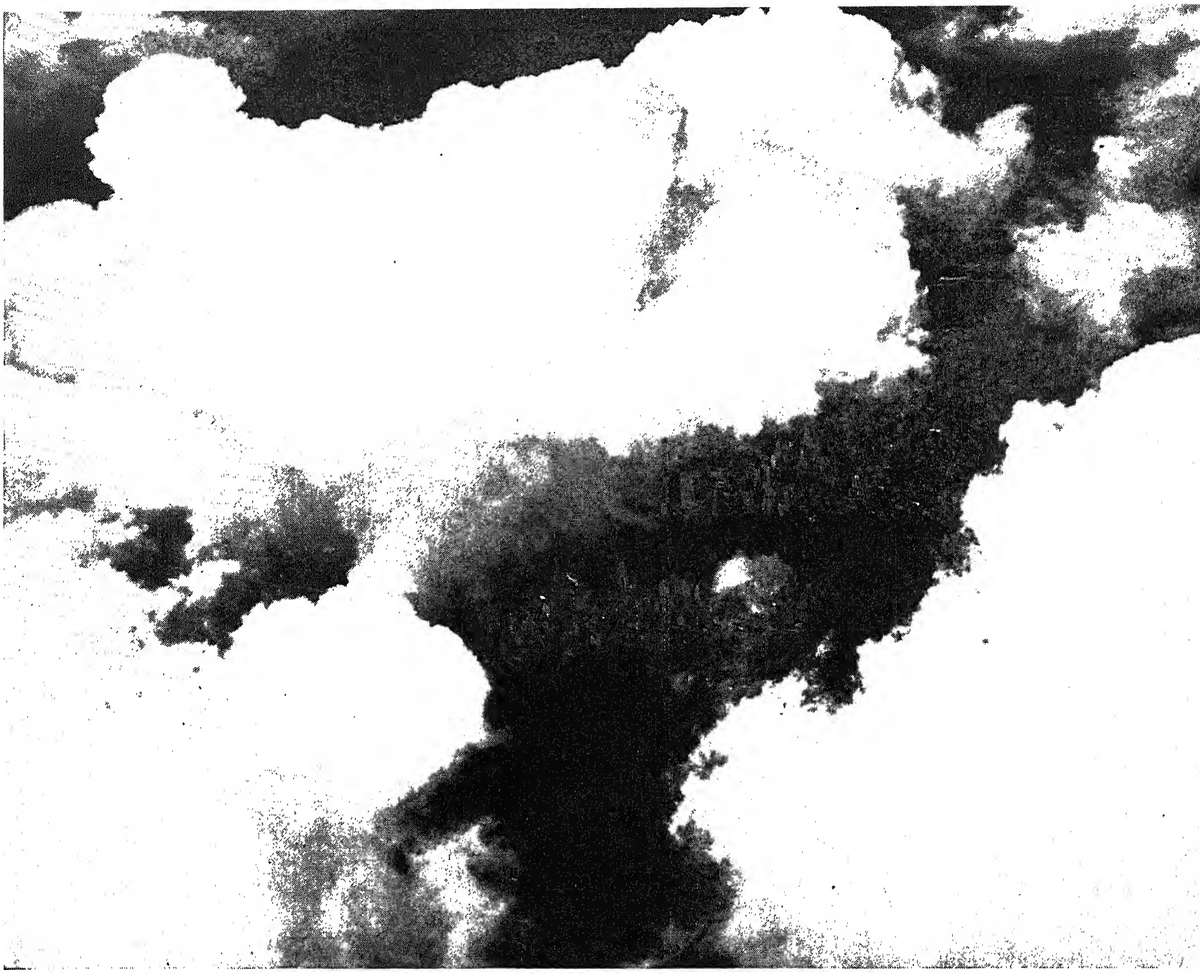
2. Film is so standardized, it is needless to go into detail about it, except to say that fast panchromatic film is best for aerial photography. I personally am using Super XX film at the present time.

3. The personal factor involves a knowledge of flying, an imagination and a sense of beauty. This factor is governed by fewer technicalities or set rules than are filters, films, lenses and developing technique.

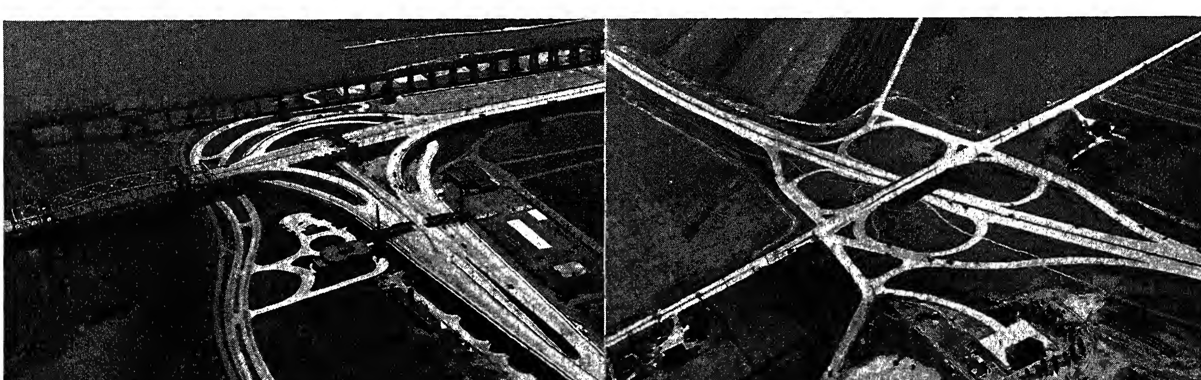
The professional aerial cameraman is familiar with the A-1, A-2, A-3, Minus Blue and G filters but a knowledge of all these is no more essential to the amateur photographer than geodetic maps are essential to an outboard motorboat navigator. The important ones are the Aero-1, similar to a K-1 but slightly denser, the Minus Blue and, occasionally . . . and only occasionally when clouds are to be taken . . . a red filter. I probably have taken as many cloud pictures as any man in the game and I could count on the fingers of one hand the times I have used a red filter. The red filter is most effective above the clouds and with the sun directly in back of you, but its use calls for much experimenting. I question its value for everyday aerial photography.

No filter will penetrate smoke or dust haze, because this haze is composed of solid particles. All a filter can do then is subdue the radiation reflected from the haze. My suggestion is to go home and play checkers when you run into smoke or dust. There is nothing one can do to obtain a suitable photo until the atmosphere clears.

11. AERIAL CONTRASTS. The congested residential section in Philadelphia shown in the left picture makes a dramatic contrast with the new Chicago housing project shown in the right photograph. Such pictures can be used in many ways from a social angle as well as from the engineering and architectural viewpoint. Left photo from American Airlines. Right photo from U. S. Public Works Administration.



12. NEW YORK CITY as seen through the aerial camera of Charles H. McLaughlin at 12,000 feet altitude. 1/200 second, f:5.6, Aero 2 filter, Fast Pan film. This makes a good picture for mural or screen. Also when cut into three panels there are no dead spaces because the interest and composition extends from the upper right to the lower left in the entire view. In judging the exposure it is important to arrive at a compromise because of the extreme variations between the brilliant clouds and the dark ground shadows. See text for additional information.



13. TRAFFIC CIRCLES FROM THE AIR. When photographing highways and traffic circles it is better to have a thin negative and print for contrast according to Charles H. McLaughlin. Left picture shows the New York Triborough Bridge central traffic layout . . . focal plane shutter set at 1/160 second, f:8, Aero 2 filter, Fast Pan film. Right view shows another traffic circle near New York . . . 1/140 second, f:8, Fast Pan film.

14. **INDIAN PICTOGRAPHS.** Only an aerial photo can show these 90 foot drawings spread out on the Mojave Desert in California. American Airline Photo.

I recommend an Aero-1 filter for low altitude flying (under 2,500 feet). It can be used at high altitudes on extremely clear days. The best filters for high altitudes are the Minus Blue and the G. Both of these filters tend to penetrate blue haze and increase the contrasting qualities of the photograph and make possible photographing distant objects that are barely discernible to the naked eye. There are hundreds of reasons for and against every filter and each photographer has his own ideas, but the consensus is that a Minus Blue filter is best for high altitude photographs and that either the Aero-1 or Aero-2 is best in low altitude photography.

Where the subject to be photographed varies greatly in contrast . . . such as a view of the earth through the clouds in which the detail in both clouds and ground is desired . . . no filter will be entirely satisfactory. You can get a fair negative, but for a good print **corrections must be made in printing.**

15. This air view could have been improved if the photographer had snapped the shutter just a fraction of a second sooner to get the outline of the airplane over the ocean. Ground backgrounds are important.

Printing Corrections

By corrections in printing I mean bringing out certain detail more strongly or subduing it by what might be called tricks. For instance, on a shot of clouds with a portion of the ground showing through them, you may notice that the part of the negative where the clouds appear is very dense while the part where the ground appears is thin, sometimes almost transparent. To get a print that will do justice to both, it is necessary to hold the thin section back and give more time to the heavy part.

The usual shading method helps a lot, but a little coccine rubbed over the thin part of the negative to form whatever density is desired makes printing easier. If, after the paper is exposed, it is found in developing that the dense part of the negative has not printed out enough, a piece of cotton soaked in concentrated developer should be rubbed over the dense sections quickly but gently for a few seconds. Then just as quickly, the paper should be put back into the regular developer to avoid staining. (This is called waking the dead!) Often, if the density is almost but not quite what is wanted, it will be found that the concentrated developer is too strong. In that case, the operator should just wet his hand in the developer and gently rub dense parts of the print with the palm of the hand. The heat of the hand will help to bring out much more detail. Paper will be wasted in trying out this trick, but after one gets on to it, he will be surprised at some of the results, and the waste will be inconsequential.

I learned my profession back in the early days of aerial mapping. I was quite successful in getting contracts for aerial photographs, but was not too successful in shooting the pictures. Something was wrong and I blamed myself.

Air Comfort And The Photographer

I studied the camera, talked to "experts," confided in the pilot and took great care on each job. The results were only passable. One day Lewis MacSpaden, one of the oldest aerial photographers in this country (he worked with Lt. Colonel Albert W. Stevens in the Air Corps prior to 1920), asked me if I were planning to take pictures. I replied in the affirmative. "If I were you, I'd get comfortable," he said. "It's the only way you can get consistently good results."

I looked the situation over. I was sitting on the edge of the seat with no safety belt, no door on the ship and fifty pounds of camera on my lap. No wonder I was "door shy!" No wonder my pictures were always taken at too flat an angle! I had to think of my own safety at the same time I was taking a picture. So *that* was the trouble!

I immediately piled several seat cushions on the floor near the door frame, tied a rope around my waist and secured each end to a seat. I was comfortable and I felt

secure. The results were excellent. I couldn't wait to get into the air.

My first advice to a flying cameraman is, therefore: Be comfortable. If you don't feel secure you're not comfortable, and vice versa. Be both. You'll then find plenty of time to study your subject and enjoy and photograph beautiful settings.

All aerial photographs should be taken with as little relative motion between the plane and the subject as possible. This means that the camera should be aimed at the subject while flying toward it or away from it. The most unusual angle is toward the rear, as close to the tail as possible without including the tail in the picture. The pilot can help by throttling the engine and banking gently. However, the chief cause of spoiled pictures is bumpy air, and it is perfectly possible to take sharp pictures at altitudes as low as 1,000 feet from an airplane moving at 200 miles per hour, providing the camera is swung slightly in the direction of the object.

Imagination is very important. When you see something promising, anticipate what it will look like on a print and study how you can get it the way you want it on your negative. Having done that, circle, climb, or descend in order to secure the best possible composition. Take your time. Haste makes waste.

How A Professional Aerial Photographer Works

A number of full-time aerial photographers are constantly at work under the direction of Edward G. Bern, American Airlines Director of Publicity. One of these veteran photographers, who has flown many thousands of aerial-photography miles, is Merle Oelke. Here is a brief statement from him regarding his aerial work.

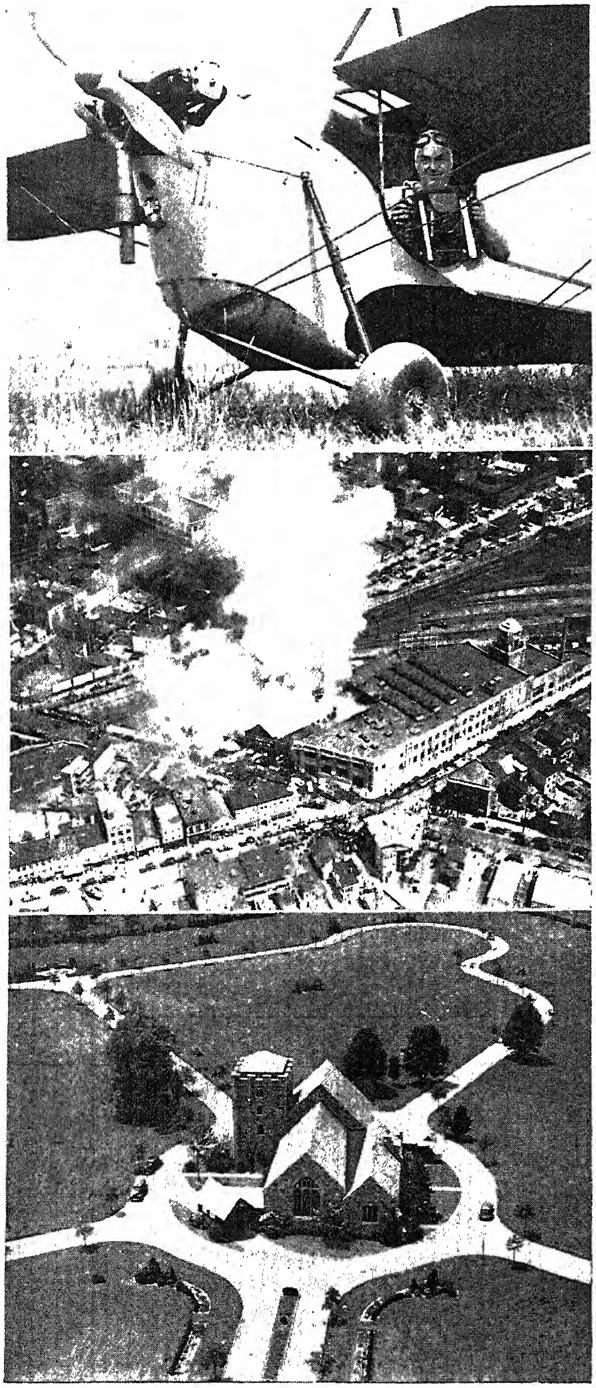
"There are several positions from which we can photograph from an American Airlines Flagship. In making some of our publicity photographs the rear baggage door is often removed. This permits full use of my 4 x 5 Speed Graphic for either black and white photographs or for use with Kodachrome. However, I usually work from an open cockpit window. Vibration and movement only enter the picture during bumpy air, or when the camera is placed too close to the window. The Graphic is seldom used from this position when the window is open. It is essential to keep the camera away from outside air currents during the actual exposure. I seldom use a faster speed than 1/295 with an Aero-2 filter, with the lens stopped down to f:8. Naturally this exposure is relative to the subject just the same as the filter and lens stop. This exposure was used to make the black-and-white photograph over Niagara Falls.

"Exposure meters can be used in the air, if you are careful not to get the reflection from the highly polished wing. There can be a difference of two stops between the reflected ground image and the close-up wing reflection. With an exposure set for such a bright wing or cloud reading, it is practically impossible to get full exposure and other ground details in the rest of the negative.

"Our biggest problem in getting suitable pictures for publication, showing a flagship over a scenic spot, is timing. It takes a lot of teamwork between the pilots. Many times the camera ship is too slow. In order to offset this, the landing gear on the flagship is lowered to

16. IMPORTANCE OF SHADOW DIRECTIONS. In most cases when studying vertical aerial photographs it is important that the shadows fall toward you when looking at the picture. While the photograph at the right, taken near the Matanuska Valley in Alaska, is an oblique picture, it does give a very good example for shadow study.

Turn this picture upside down and you will find that the elevations have become depressions. Thus it is very important to orientate the shadows of every vertical picture. Photo by Willis T. Geisman. 1/440 second, f:4.5, K2 filter, Fast Pan film, 4 x 5 Graflex camera.



17. (*top photo*) John F. Hicks with a 5 x 7 Speed Graphic camera. Special braces and extra handles are built on to the camera for additional stability.

(*middle photo*) A fire in Newark, New Jersey. Photo by John F. Hicks. Altitude of 1,000 feet. 1/350 second, f:11, Fast Pan film.

(*bottom photo*) Restland Memorial Park, Hanover, New Jersey. Same data as fire picture. John F. Hicks Photo.

slow it down. Then enters the problem of how to photograph a ship in a good position and not show the landing gear. In the photograph on page 244, made over Niagara Falls, the landing gear is down but the particular angle, from which the photograph was made, does not show this landing equipment. Whenever possible, we communicate with each other by radio telephone. This makes the flight much easier and everyone knows what is going on. Unfortunately, many of the airships that are used by the cameramen are not radio equipped for this type of communication. It is a great help to use the same pilots who have flown for pictures at some previous time. Such pilots have a better understanding about the photographers' problems. We try to fly on the left when photographing another ship, so that the captain is on our side and can maneuver his ship according to our requirements. Of course such a position depends on lighting conditions for the background.

"Aerial pictures which have given me the most trouble are those showing a big forest fire, formation flying, flying over scenic views, flying and climbing 17,000 feet to get above for a certain flying picture and almost freezing up while getting there."

Low Altitude Aerial Photographer

Out in South Orange, New Jersey, John F. Hicks has been doing some interesting aerial work as a professional. He is a one-man aerial photographer, owning his plane, camera, and also his own basement darkroom. Here is what he has to pass along for your information:

"My special interest is in taking oblique airviews at heights from 500 to 1,500 feet. The equipment involved is a little Aeronca, typical of the 'light plane' type, and a Speed Graphic camera. The whole job is done alone: flying the ship (with the knees) while shooting; then processing and selling the pictures. Since the most important step lies in getting the best view of the subject, it is just as easy to put the ship where you want it and shoot alone as it is to get coordinated with a cameraman in cramped, noisy quarters.

"The Graphic is a 5 x 7 model with a 27cm f:4.5 Schneider Xenar lens. I have the bellows protected, the lensboard rigidly fastened, special spring brass handles, and a lead counterweight that brings the camera up to 15 pounds. These things all help to minimize the effect of motion induced by the speed of the plane itself; engine vibration; the photographer's hand; and, worst of all, the buffeting effect of wind gusts—usually severe on clear bright days.

"My standby in film is Eastman Super XX; in packs, for convenience. Average bright day exposures will be about 1/550 second at f:11; and, contrary to standard practice . . . without a filter.

"I have used several cameras in the air, from 35mm outfits on up. While results have improved almost in direct proportion to negative area, this camera is as large as I expect to use. By plotting the cost of camera.

lens equipment, and photo supplies against what people seem to want to pay for air pictures it looks as though to go larger than 5 x 7 would be to argue with the law of diminishing returns. Furthermore, with a bucking airplane in one hand and a big Graphic in the other a fellow isn't exactly unemployed.

"Darkroom facilities in our cellar are nothing to brag about but we do turn out 16 x 20 prints which sell. Occasionally, when a news shot happens to come along I go directly to the newspaper offices and develop the film in their darkroom in order to make the deadline. Nine out of ten of my pictures, though, will be of some new housing project, a private estate, factory, golf club, or similar subject."

How To Read Aerial Pictures

After you have made your first series of aerial photographs, you will be interested in studying the enlarged prints. One of the first things to do is to orientate the photograph. That is, place the print in the natural viewing position. Draw an arrow pointing North. Make another arrow giving the direction of light. If you have made a vertical aerial photograph, it is much easier to study such a picture if you turn the photograph so that the shadows point toward you. On the back of your photograph place the date and also the time of day when the picture was made. Also add information about the location of the photograph. Other information of interest may be added, such as altitude, type of film and filter used, focal length of lens, and also the number of your negative. This information will be of value for future reference.

In studying an aerial photograph there are a number of special factors to be considered, in order to obtain a better understanding of the ground features. These points might be divided into three parts:

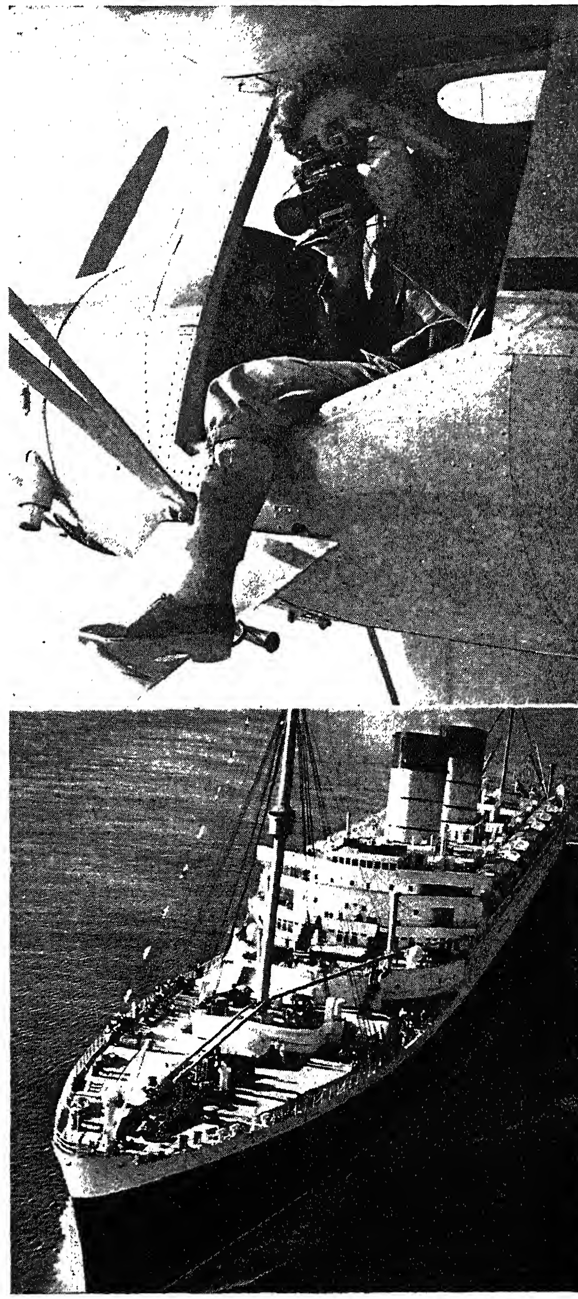
1. Natural ground terrain with its variations.

2. The elevation of the ground is of special importance. This may also be classified under the study of relief or texture, which can be determined by examining the ground impressions, excavations, dry river beds, and other features.

3. The third classification includes all features which have been constructed by man or changed from their original natural appearance.

We can obtain some idea about the height of cliffs, buildings, trees and other ground objects by a careful study of the ground shadows, the shape of cultivated fields, the winding curves of unimproved roads, which follow the natural contours of the hills. Even the railroad excavations and cement highways give us excellent clues about the slope of ground. Swamps or other moisture areas show evidence of low depressions.

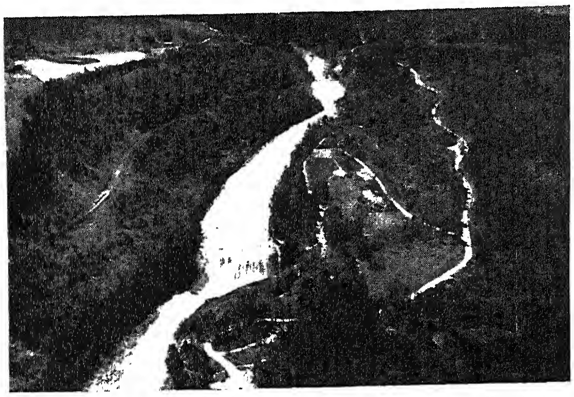
The aerial photograph reveals all the minute details of mountain ranges, forests, lakes, and rivers, shore-



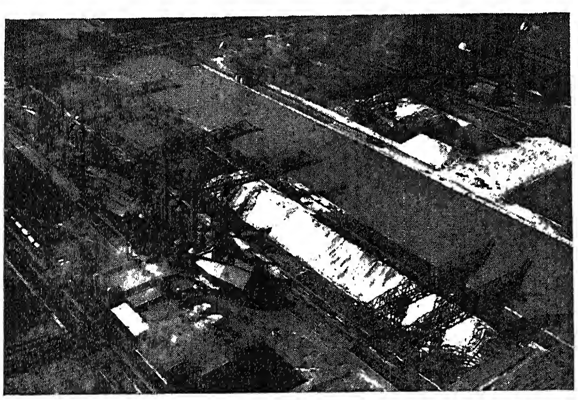
18. (*top*) **Photographer Keston Pelmore uses a 2¼ x 3¼ Speed Graphic equipped with a Busch Bis-Telar 34cm telephoto lens and the A filter. (Now an R.A.F. pilot)**

(*bottom*) **The new "Mauretania" approaching New York. Photographed at a 350 foot altitude, Ross Express lens at f:4, A filter, 1/180 second, Fast Pan film pack, 7:00 a.m. Keston Pelmore Photo.**

19. GRANDMA'S PATCHWORK QUILT. An interesting aerial view showing various types of cultivated crops. All photos on this page by American Airlines.



20. GENESEE RIVER, NEW YORK. Note different types of roads, single track railway at left, appearance of water and falls, and other ground details.



21. GARY STEEL MILLS. There are many examples for making outstanding aerial pictures of high quality. One can study a picture like this for a considerable time and discover many things.

22. WELLAND CANAL, CANADA. Many things can be learned from this picture. Note the roadways, crossing of river, bridge, and barge coming through canal.

lines, sand dunes, orchards, and other quickly identified features. All these points help to identify various differences in elevation or ground relief. For example, we can mention the following:

1. **Forests.** Small or large areas of standing trees are quickly identified. Here we can find a burnt-over forest, a dense forest or a young woods. You can also point out the various heights of trees in comparison with other natural features or low underbrush.

2. **The rivers and small streams** are also easily recognized by their irregular courses. You will soon be able to identify a dry river bed as compared to one filled with water. By keeping information about the date of the photograph, you can later determine when the river is full of water during certain weeks of the year.

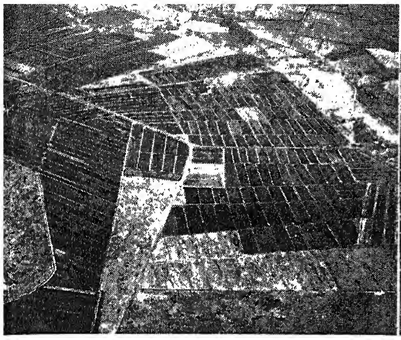
3. **Lakes and other bodies of water** may show up as light or dark areas, depending upon the light direction when the photograph was made. Only the air picture can show you the exact outline of the lake, dam, canal, harbor, or any other body of water.

4. **The regular planting of orchards,** such as orange groves, peach or apple plantings, can be quickly recognized. The only difficulty here will be to identify the type of trees. Usually this can be done after some knowledge of the locality has been obtained. There are over a million trees in the immense Amawalk nurseries in New York State. Aerial photographs have made it possible for Eric Hodge, the owner, to count and identify every one of his trees. Dead trees can be spotted and replaced very easily by studying successive aerial views of this property.

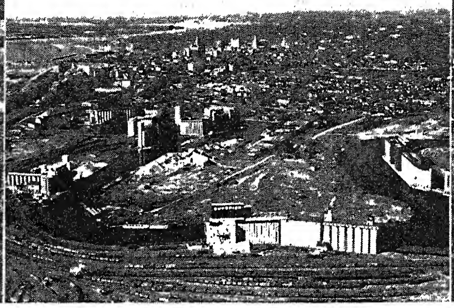
5. It has taken man only about two centuries to completely change the surface of the present territory included in the United States. During this time roads, bridges, buildings, and all types of new construction have radically changed the appearance of the ground surface. Aerial photographs which might have been made three hundred years ago of our virgin continent would have shown miles of forests cut by lakes, streams, rivers and other natural features. Today we have a totally different physiognomy of this ground. In our aerial travels and studying, we can find considerable interest in learning to identify these new universal changes.

Old and Modern Changes and Constructions

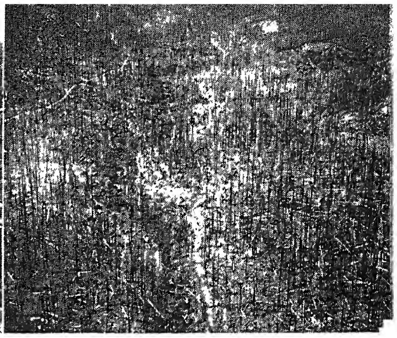
1. **The great networks of railroads** which cross and crisscross the country are a familiar feature. These railroads are usually narrow as compared with the improved cement roads. Also, the railroad is very straight. Then there are special points, such as the freight yards, stations, water tanks, stock pens, warehouses, and similar identifying features. Learn to note the difference between the single track and double track railroads.



23. CELERY FARMS. Note the interesting ground pattern in this aerial view.



24. BUFFALO, N.Y., TRAIN YARDS. Showing relation of tracks for transportation to the city proper.



25. BURNED-OVER FOREST. Photo from Soil Conservation Service.

2. **Improved and unimproved highways** are also known features. These roadways do not have the straight characteristics of railroads, although many of the new cement roads are very straight. The cement roads show up in the aerial photograph as narrow white ribbons. Unimproved roads have more curves and may vary in their width as well as their light and dark parts in the picture. You will also be able to identify small trails leading away from main highways. These naturally vary according to the frequency of traffic.

3. **Industrial plants** can be quickly identified by their construction, accompanying rail yards or wharves. Also the type of buildings and smokestacks make them recognizable. Many times the name of the firm is painted on the roof of the building.

4. **All types of bridges,** made for railroads and highways, offer additional interest in the aerial picture. In the oblique photograph it is usually quite easy to identify the type of construction of a bridge. It is also important to study the various types of approaches to a bridge. This is helpful in traffic investigations. All types of buildings can also be studied very easily in the oblique aerial picture; the country home or the city apartment and office building can usually be identified by their architectural characteristics. Also their height can be estimated by counting windows on each floor, or by studying the shadows cast by the building.

5. **Improved land** offers many variations for the aerial picture. Newly plowed fields will show up very dark as compared to a field of ripe grain, which is very light. Usually the fields which have green vegetation, such as corn, alfalfa, and other crops appear dark in the aerial picture, while the other fields appear light. The actual shade of wheat land is easily determined in the air photo.

6. There are naturally many other ground points of interest, such as winding paths, cemeteries, which show up the small white dots of the tombstones, eroded land, golf courses, waterfalls, canals, and even archaeological formations, all of which help to add significance when thoroughly studying the aerial photograph.

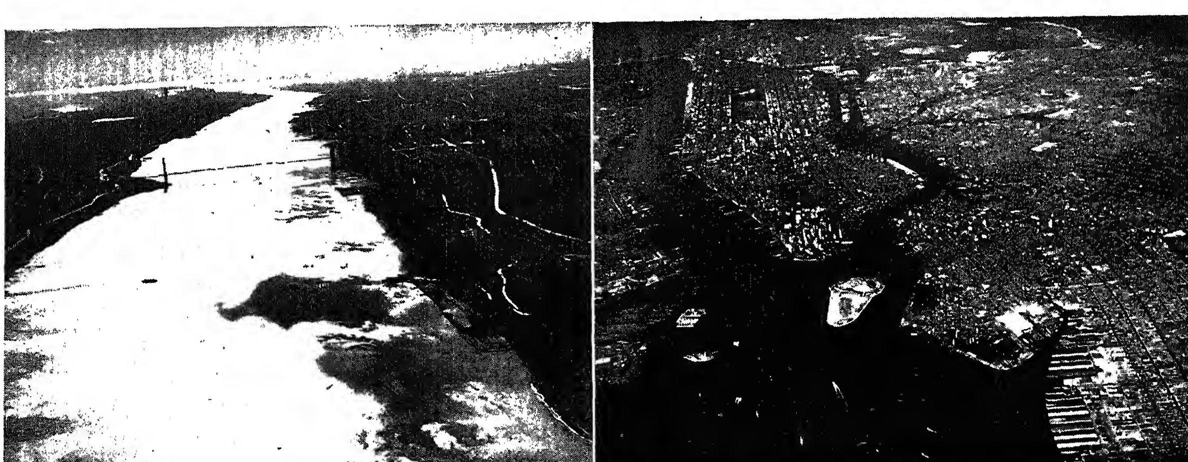
These specific points already mentioned in studying the aerial picture are of special interest. For example, when we look at a road, we know that it always leads somewhere. In following this road we can build up our own speculations about the countryside it passes through, the bridges which lead over small streams or into small towns. Careful study of the accompanying photographs will give you more concrete ideas about what to look for in an aerial picture. With the technical facilities of the camera so completely solved, the actual mechanics in making an aerial photograph are reduced to a minimum. Now we can emphasize the utility of aerial pictures more completely. You will find a new interest in this type of photography, by following these suggestions, and by securing a more complete understanding of every aerial photograph you may make yourself, or may see in any publication.

26. ERODED GULLIES. Note appearance of dry stream beds and eroded hills.

27. GULLY EROSION CONTROL. Showing typical reclamation work by Soil Conservation Service.

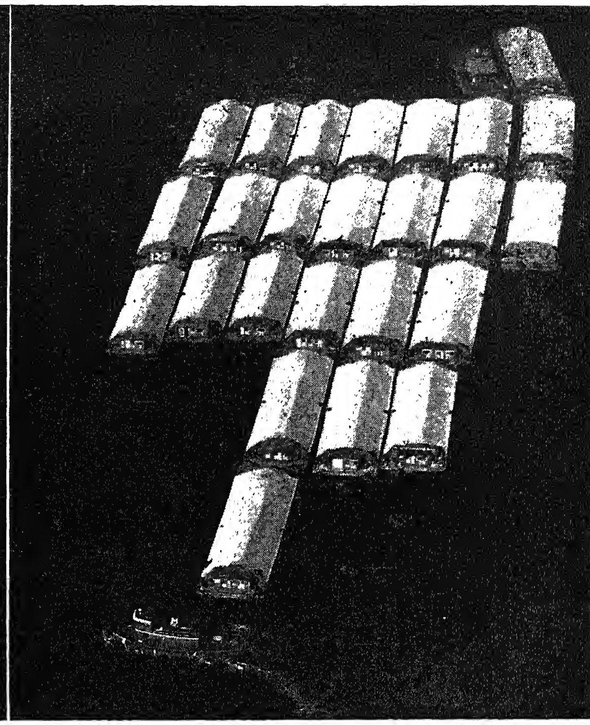
28. TERRACING. Another method of soil conservation as seen from the air.

29. **ALLEGHANY MOUNTAINS** from an altitude of 18,000 feet. Photo made over Potter County, Penna. by Charles H. McLaughlin. Made with 8¼-inch f/4 Ross lens, 1/80 second at f/6.3, Aero 1 (No. 3) filter. This is the type of picture made from a direct vertical position for aerial mapping purposes. Also stereoscopic aerial views can be assembled from a series of these pictures.



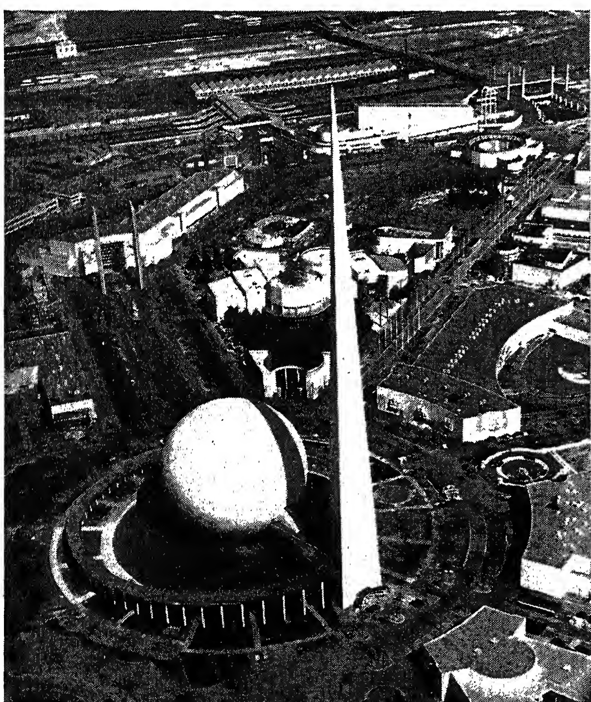
30. **WATERWAYS OF NEW YORK.** These two views of the Hudson River flowing past New York City show how to photograph water with two different photographic methods. The picture at the left was made against the sunlight. This created the highlight reflections and the waterway looks very light . . . focal plane shutter set at 1/180 second, f/8, Aero 2 (No. 5) filter, 12-inch lens. Exposure made at noon on Medium Fast Pan film. View at right looking north on Hudson River shows dark waterways with sun coming from the side . . . 1/200 second, f/18, G, 15 filter, Fast Pan film.

31. **WATER BUGS.** The annual Poughkeepsie Regatta takes on this strange appearance from the air...1/60 second, f:4.5, Aero 1 filter, 10-inch Schneider f:4.5 lens, exposure at 7 p.m., Fast Pan film.

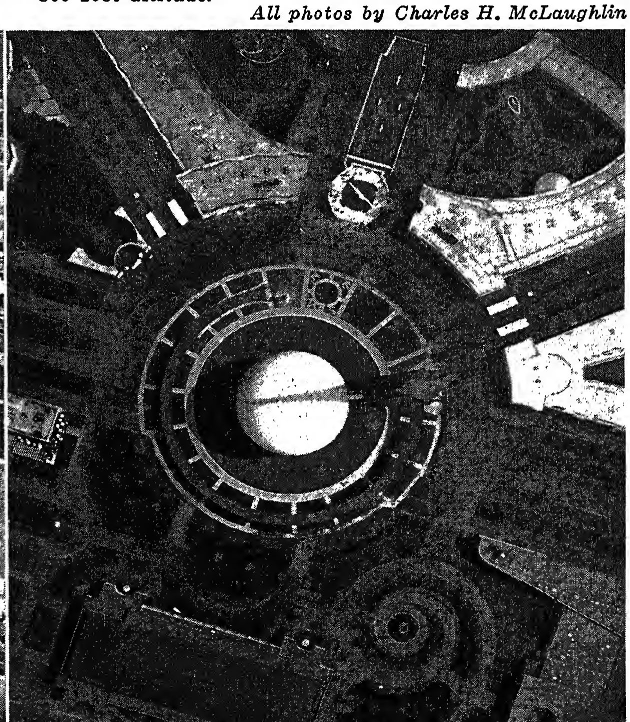


32. **PATTERN OF INDUSTRY.** Sand barges off Long Island create this dramatic picture. Focal plane shutter set at 1/140 second, f:16, Aero 2 filter, Super XX film, 800 foot altitude.

All photos by Charles H. McLaughlin



33. **OBLIQUE VIEW** showing the familiar form of the Trylon and Perisphere. 1/140 second, f:16, Aero 2 filter, Super XX Pan, 500 foot altitude.



34. **DIRECT VERTICAL** showing Trylon and Perisphere at 4,000 foot altitude. 1/200 second, f:16, Aero 2 filter, Fast Pan film. Optical center is center of the Perisphere ball.

1. ROOMING HOUSE FIRE. This was the first picture made after arriving at the fire. All the victims had left the building and the Fire Department was rapidly getting the fire under control. Note the bedsheet hanging out of the front window where a survivor slid to safety. A 4 x 5 Speed Graphic camera was set on a tripod for time exposure. One flashbulb was fired from behind the extension ladder truck and one in front of the building to light up the front porch. The camera shutter was left open for about 25 seconds during the flashing of the two bulbs and the general exposure resulting from the light of the fire. Shutter set at f:16, Superpan film. Frank Scherschel Photo, *Milwaukee Journal.*

NEWS AND PRESS PHOTOGRAPHY

FRANK J. SCHERSCHEL and STANLEY E. KALISH

Newspaper Photography Today

Pictures are the greatest development of the century in the newspaper field.

If you doubt it, go to the nearest museum. Ask to see a paper some fifty or seventy-five years old. Look it over and you will find that it is just about as easy to read as the one you can buy on the corner with the ink still wet. True, the type is not as streamlined, the stories not as jazzed up, the make-up not as appealing. But the big difference is in the pictures printed. The museum piece may have a woodcut or two. It probably doesn't even have that. Today's newspaper, on the other hand, has forty or fifty pictures all reasonably well reproduced.

Yes, in the century since photography's birth, newspaper pictures have come a long way. Their real birth, as far as newspapers are concerned, was in the 1880's when photoengraving was developed. But until 1919, newspaper use of photoengraving was a rather indifferent one. The birth of the tabloid newspaper in 1919 brought the first dim realization that John R. Reader likes to look at pictures. A few farsighted morning newspapers produced full pages of pictures in the years that followed. Their afternoon rivals at first were reluctant to follow, pleading that they did not have time to gather the day's pictures into a page. But they, too, began to publish picture pages, until today nearly every large newspaper and a great many small ones have such pages. Each year finds newspapers publishing more and more photographs. The general manager of such a conservative organization as the Associated Press has gone so far as to predict that newspapers eventually will be half pictures.

As newspapers became aware of the public interest in pictorial journalism, equipment and technique quickly changed in half a dozen years.

Prior to 1931, the newspaper photographer was a public smoke nuisance. He had to use flash powder to make most indoor pictures. Everyone recalls the nerve-tingling roar that accompanied every indoor photo. Most news photographers remember firing the flashgun, hurriedly glancing about to see how badly the curtains had burned or the wall had streaked, hustling away after a cheery, "Thanks a lot," before the smoke had settled and asphyxiated the subjects. It was a distressing experience for the photographed and a dangerous life for the photographer. Every smart lensman had Unguentine handy for powder burns. A few had tragic experiences. Eddie McGill of the *Chicago Tribune* suffered a fractured skull when a big flash pan bent as it was fired. Nick McDonald of the *Chicago Herald-Examiner* lost a hand when powder that he was pouring from a bottle into a hot pan exploded.

These perils of photography were practically eliminated when flashbulbs appeared in the summer of 1931. The first importations from Europe were ridiculed by the singed veterans of powder. Now even the most skeptical of them is convinced that the bulb is the greatest advance in news photography since the dry plate and cut film. (The latter, too, had a hard time winning popularity.) American-made bulbs soon followed the European ones. They were cheaper and just as sturdy, although the early bulbs had a habit of exploding when fired. Next, the first synchronizer by Hipwell appeared. The tripping of the shutter and the flash of the bulb had not been synchronized, so the two bulbs were used. They went off an instant apart to produce a longer light peak. Synchronizers and bulbs soon were made that actually were synchronized with the camera shutter. Samuel Mendelsohn made his Speed Gun. Morris Schwartz produced the Kalart Speed Flash. Today there are a number of good synchronizers on the market which work very satisfactorily.

A later development which the use of flashbulbs brought was the focal plane or back shutter synchronizer. The first synchronizers were operated on the between-the-lens shutter. Their maximum rated speed was 1/200 of a second, not nearly fast enough for some types of pictures. When long peak bulbs were introduced in 1937, Robert Dumke, a *Milwaukee Journal* photographer, devised the Smeaton back-shutter synchronizer which permitted pictures to be taken at 1/1000 of a second with the curtain shutter of the Speed Graphic. *The Detroit News* devised a similar mechanism and the same feature now is incorporated in the "midget" size $2\frac{1}{4} \times 3\frac{1}{4}$ Speed Graphic.

Other New Changes

Flashbulbs and synchronizers brought film changes. Whether today's panchromatic films are better than orthochromatics is debatable. For speed, the pans easily win, for they have been made faster and faster. But the news photographer of today frequently overlooks the reliable orthos. Undoubtedly both should be used under certain conditions.

Naturally, with the rise of newspaper photography, engraving processes had to be improved. The Powers camera which introduced stripping film to replace the wet plate was a particular boon for speed. Cut strip film made the one-man engraving plant a financial possibility for small newspapers. With the reduction in engraving costs, the picture claims of the metropolitan papers could be met by their smaller brothers. Other strip film cameras have followed. Newsprint has been improved, too, so that half-tone screens could grow finer to get more quality in reproduction. From fifty-five lines to an inch, half-tones for some papers now are made upward to eighty-five.

Flashbulbs, film, engraving processes are all obvious developments in the rise of current news photography. The picture magazine is subtler.

2. AND SUDDEN DEATH . . . photographed by H. E. Klappert, Jr., during stormy winter evening on Jericho Turnpike near New York City. 4 x 5 Speed Graphic, 1/200 second, f:8, one flashbulb, Super Plenachrome Press film. A first prize winner in 1939 Inland Daily Press Association Contest.

The modern picture magazine put drama in pictorial journalism. Not that the picture magazine of 1936 was a new idea in journalism. It was not. *The Midweek Pictorial* had tried to exist for years and died at a moment when it might have continued to live. We believe that it failed for four reasons. First, it existed in the days before the flashbulbs that make it possible to take dozens of pictures to the two or three made with powder. Second, fast films were not available. Third, the big city folks had seen the same pictures in their newspapers; the small-town ones had not been taught the picture consciousness they were to learn with speedy engraving and mat services and one-man staffs for their small dailies. Fourth, the photography craze that came with the miniature camera had not developed.

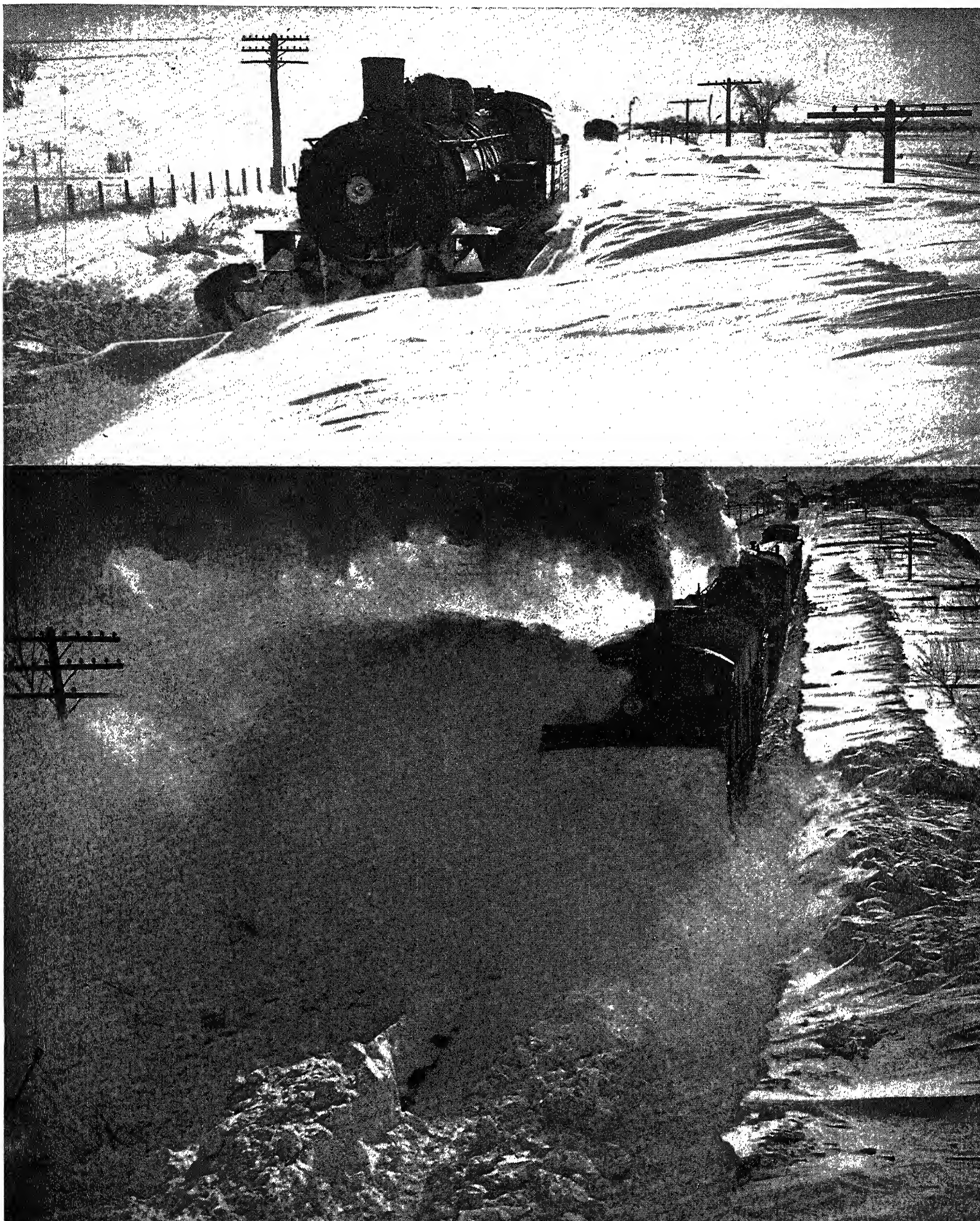
When *Life* and the other picture magazines appeared, a new photo technique was emphasized. They demanded that a picture be more than a mere carelessly made photo. They required that it be as perfect technically as possible. They profited by the early technical leadership of *Vanity Fair* and its cousins of fashion, *Vogue* and *Harper's Bazaar*. To the portions of news photos and outstanding pictures, *Life*, in particular, stirred in the picture story. It impressed on newspapers the value of that technique. A few papers, notably the *Milwaukee Journal* and the *Des Moines Register Tribune*, had been grappling with the picture story before *Life* appeared. *Life*, too, awakened newspapers to the use of background pictures in telling stories. It has given dozens of hints in picture getting and handling to newspaper photographers and picture editors.

Every smart newspaper knows that the magazine is a friendly competitor. It has awakened papers to the necessity of presenting pictures in as effective a manner as possible so that the paper may compare favorably with the magazine.

The Newspaper Photographer

Sometime, somewhere, the perfect photographer will be found. He will have boundless energy, never want to eat, never miss a picture, and will always get correct names and addresses. He will be able to grow to reach above the crowd and get his shot. He will contract to invisibility when he should not be seen. Everyone will love him, including his family which will seldom see him, for even this superman will always be on the job.

But until that man appears, the common pounds of flesh and mind will have to get along. Not so long ago the news photographer was a dumb, tough guy. He no longer is dumb and seldom is tough. He has learned, and so has his newspaper, that his job is a key one. He meets more readers than any other employee and must be the paper's ambassador. He has to be a psychologist, know when to use flattery and when to be as hard boiled as a picnic egg. He used to be the automaton at a reporter's beck and call. Now he is on his own a great deal of the time—knows that a picture missed is a picture never obtained. He has learned that he is in a highly competitive business and one that is growing more competitive. No longer do the copy boys become



3. SNOW PLOW TO THE RESCUE. The stalled engine in the snow and the lower snow plow picture represent two photographs covering an assignment in the middle of winter after a blizzard. The rescue train had this engine free of snow in about ten minutes after its arrival. A typical example of the unexpected assignment. The photographer must be ready to leave on such assignments on a moment's notice. In this case, one photographer went out in his regular city clothes and couldn't stand the sub-zero temperature. The result was that he had to leave the scene before the real dramatic action took place. Exposure 1/295 second at f:11, Panatomic film. Frank Scherschel Photo, *Milwaukee Journal.*

4. GOAL. Made with a 12-inch lens on a 4 x 5 Graflex camera. 1/120 second, f:4.5, Superpan Press film. Carl Thusgaard Photo, Acme News Pictures, Inc.

5. FARMER AND HIS CROPS. Made for a women's page feature on a farmer's market . . . at 5 a.m., two synchronized flashbulbs, 1/200 second, f:16, Superpan film. Frank Scherschel Photo, *Milwaukee Journal.*

the photographers. Instead, college graduates who know what is going on in the world are learning that newspaper photography is the newspaper field of the future. Today's smart photographers don't confine their reading to the sport pages and the comics.

Of course, every newspaper has its ace cameramen. But may Providence deliver photo chiefs from entire staffs of those temperamental geniuses of the lens. What would happen to those routine assignments which are four-fifths of the work? The wise paper balances its staff between the prima donnas and the drones.

Needless to say, the photographer has to know how to make pictures and has to have good equipment. Here is what he has at his disposal on the *Milwaukee Journal,* an average large newspaper. Every man is equipped with the 4 x 5 Speed Graphic camera with an f:4.5 lens, synchronizer, eighteen film holders, a No. 1 Crown tripod, a tilting top for angle shots, from one to three extensions for sidelighting and flashbulbs, an A and a K-2 filter and lens shade, a focusing cloth, bulbs, and a carrying case. Most of the men own a miniature camera with a fast lens for special use such as in courtrooms. Supplementary equipment available includes three 12-inch f:3.5 Graflexes which are used mostly for football pictures; a 20-inch f:4.5 Graflex and a 28-inch "Big Bertha," both used mainly for sports; one so-called "magic eye" camera for rapid action sequences; a miniature camera with an assortment of lenses and accessories. There are 4 x 5, 5 x 7 and 8 x 10 inch view cameras and a variety of lenses in the equipment locker. There is a set of Johnson portable lights. There is a studio camera with adapters to handle films from 4 x 5 to 8 x 10 inches in size. There is an assortment of modeling and spot lights. And there is a pair of hip boots for flood assignments.

Taking the Picture

The taking of good news pictures can be learned only by actual practice, for practice alone develops the trait of knowing a picture when you see one. And it is the small-town news photographer who can best develop this ability. The average cameraman in the small town bemoans his lot. True, those big national stories seldom come his way, but he forgets something far more vital in picture taking that is always at hand . . . freshness. In large cities, a dozen or more photographers frequently have to shoot together and make the same photograph. The cameraman in the smaller community works alone. He has the opportunity to develop new twists to routine picture making, and to think about improved technique and originality.

All newspaper photographs fall into four divisions:

First there is the fast-breaking, thrilling news assignment. That's Glamour No. 1.

Then there is the sports assignment. That's No. 2.

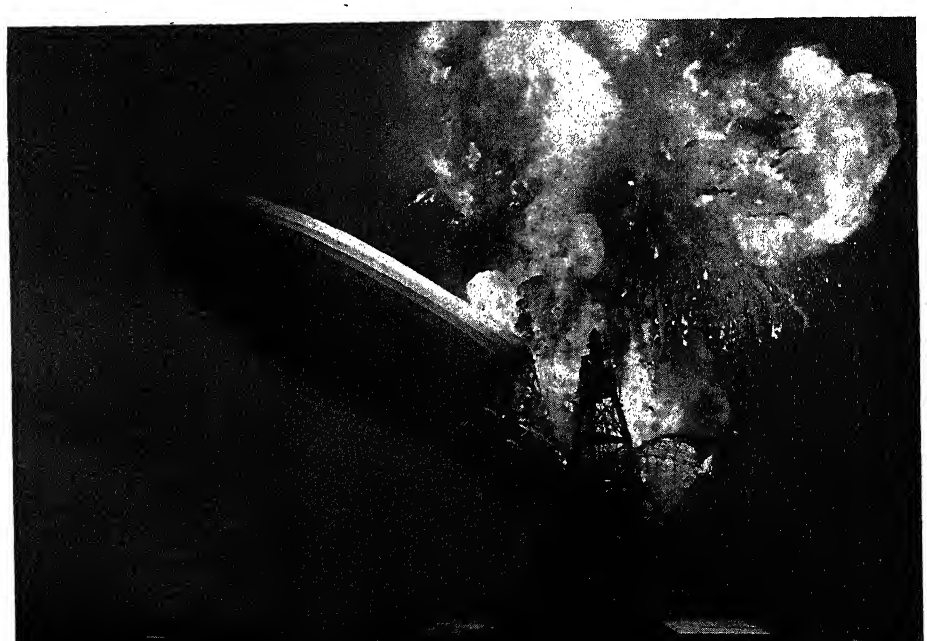
Third is the routine assignment. That's not glamour. That's eighty per cent of the work.

Finally, there are those special assignments such as society, fashions, rotogravure jobs, and commercial work.

The thrilling news story is rare and the most exciting of all news photography. There are not many jobs that fall into this class, but they are the ones that photographers will tell about when they start collecting their Social Security. At the outset, what we believe is needed in picture coverage of those big stories such as disasters, fires, and crimes is a little more thinking and a little less picture snapping. The editor's chair is a good place to begin. An efficient picture editor does not pour his photographers to the scene and hope that one of the staff will be lucky enough to get the vital picture. He is always economizing, saving his men to cover every angle, expecting each man to do his job. He knows, for example, in the case of fires if it is a factory blaze at night, that the flames and the firemen are the most vital. If an apartment house burns, the people involved along with the general scene are important. Perhaps the crowd, too, is worth a picture. The bucket brigade in action or furnishings being tossed from windows usually are better photos in rural areas than the fire itself.

There is no formula for covering fast-breaking stories. In the case of picking up snapshots and studio portraits of victims, always take all you can get your hands on. They can always be mailed back.

6. THE LAST ADDITION . . . a routine assignment. The Milwaukee Museum had completed its old-time barber shop with the final addition of the old-fashioned spittoon. Open flash with two flashbulbs on extensions, f:32, Superpan film. Elmer E. Staab Photo, *Milwaukee Journal.*



7. A THRILLING NEWS STORY. A routine assignment turned out to create an all-time spectacular photograph. 4 x 5 Speed Graphic, 1/40 second, f:4.5, Ortho Press film. Samuel Shere Photo, International News Photos.

Here are three stories that broke without warning . . . **a disaster, a fire and a murder** . . . which illustrate actual coverage.

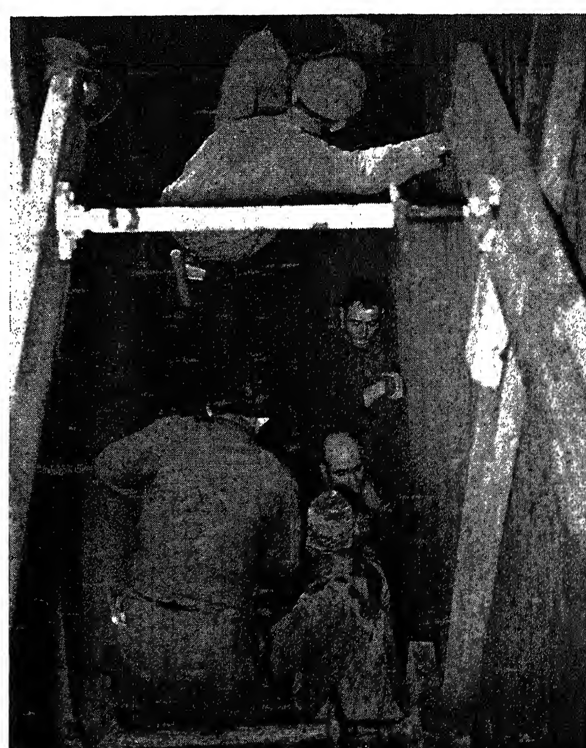
8. **A DISASTER.** A fireman carrying the son of the crying man to an ambulance has all the punch a news picture needs in covering a milling blast assignment. Synchroflash, 1/200 second, f:11, Superpan film. Elmer Staab Photo, *Milwaukee Journal*

9. **LAST SACRAMENT.** This picture was obtained at the hospital after the milling blast disaster. 1/200 second, f:11, Panchro Press film. Ivan Mashek Photo, *Milwaukee Journal.*

A Disaster

A milling concern had a terrific explosion late on a sultry summer Saturday afternoon. Most of the staff were on the routine jobs necessary to fill the Sunday paper. One man was in the office. He hurried to the scene, sized up the situation and saw that the fire which followed the explosion would last a long time (and probably would improve with age). So he concentrated on the victims who were being carried from the wrecked mill. A second photographer had been contacted at home and he arrived at the mill ten minutes later. He made several general scenes. Then he found the first man, gave him all his unexposed plates and took the holders which had been shot back to the office to start the flow of photos. Meantime other photographers had been located. The first of them went to the hospital to which the victims were being taken. (Probably the most graphic picture of the disaster was made in a hospital room.) Other cameramen were sent to the scene to aid the first photographer. The man who had been located closest to the office stopped in and took additional

10. **STREET CAVE-IN.** A typical local news picture showing W.P.A. workers after a cave-in. This picture was made two minutes after cave-in and before officials arrived and prohibited other cameramen from taking pictures. 3¼ x 4¼ Speed Graphic, synchroflash, 1/200 second, f:8, Super Sensitive Pan film. Emerson N. Shaw Photo.



11. A BARN FIRE. Ninety-seven lives were lost in this dramatic fire . . . all horses and cows. Here is an example showing excellent use of flashlight to pick up a little foreground detail, making a better reproduction in the newspaper. Also an example of a routine fire which may turn out to be a spectacular event. Synchroflash one bulb, 1/25 second, Fast Pan film. Frank Scherschel, *Milwaukee Journal.*

equipment and film with him. The first picture was in a regular edition an hour after the first tip. The next edition carried a full page of photos and a smash shot on the front page.

A Fire

An early morning rooming house fire reversed methods. The first broke shortly after five o'clock on a cold winter day. By the time the photographer pulled on some clothes, got the cold motor of his automobile running and drove part way across the city, it was about half an hour after the tip had been received. He learned that the thirty-eight people in the house had all been rescued, but the fire was doing very nicely. He set up a tripod across the street to get a view of the whole building. He stopped down to f:16, opened on "time" and ran around, firing a bulb from two different points. The total exposure was about twenty-five seconds. Some fire department searchlights helped to light the scene. The result was a spectacular picture. The fire scene out of the way, the photographer concentrated on people who had escaped and on the firemen who were working in freezing temperatures. He spent about an hour on the job and when a relief man reported, he went on to the office. Meanwhile, another photographer had gone to the hospital. He spent nearly four hours persuading hospital officials to permit him to photograph the victims. He spent a few minutes making the actual photographs.

In this case, his several hours of work, which were the hardest part of the assignment, produced only a few small head pictures. The other man, whose task had been less difficult, stole the show.

A Murder

A crime story is trickier. It seldom is concentrated like a disaster or a fire. Here is one that ran over two counties, although fortunately it was cleared up in a day. It broke about seven in the morning. A high-school girl was found dead in bed, the victim of a hatchet killer. Her mother had been attacked. A photographer arrived on the scene and was barred until police photos had been taken. So he made a general view of the house. When he was permitted to enter, he took the usual "X marks the spot" photos and tried to find portraits of the victim and her mother. None was available, so he notified the office which contacted the high school and located a picture of the girl. Meanwhile, the mother had named the slayer who had a criminal record. A Bertillon file photo of him was obtained. Another photographer went to the murderer's home to check on family connections and to obtain pictures. Word was received at noon that the slayer had been captured thirty miles away. A photographer was sent there. Another was dispatched to the local police station for pictures of the man when he was returned. In the final edition of the paper, there were seventeen photos on the case. The morning paper the next day was forced to feature a picture of a friend of the victim, so thoroughly had the case been covered.

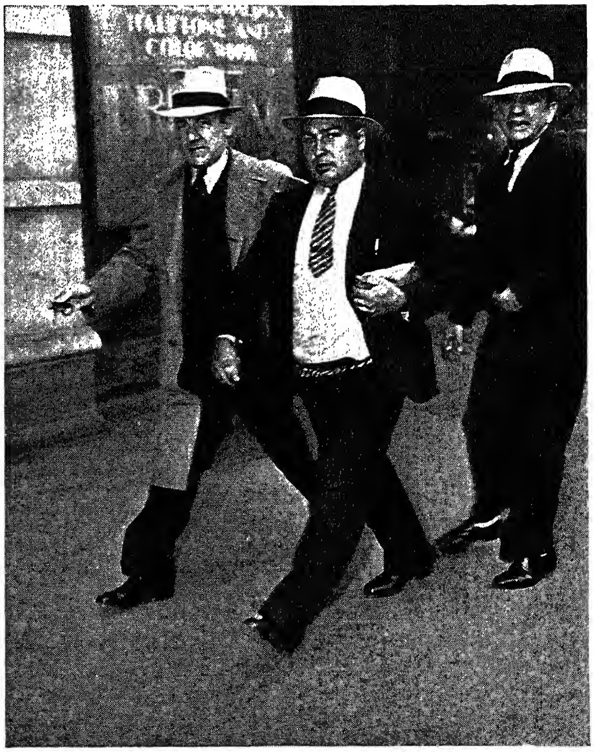
Murder mysteries are something else. Every one of them is different. It usually is the paper which is on the "inside" with the police that gets the breaks. In general,

12. THEIR BOY WAS MURDERED. Indescribable grief strikes down these women in New York City home after the Central Park holdup-murder of the 23-year-old boy of the family. Two of the slain boy's weeping sisters try to brace up a third one. The mother (handkerchief around head) watches tensely. A fourth sister (*left*) lies in utter collapse. One bulb synchroflash, 1/200 second, f:11, Fast Pan film. William Stahl Photo, *N. Y. Daily Mirror.*

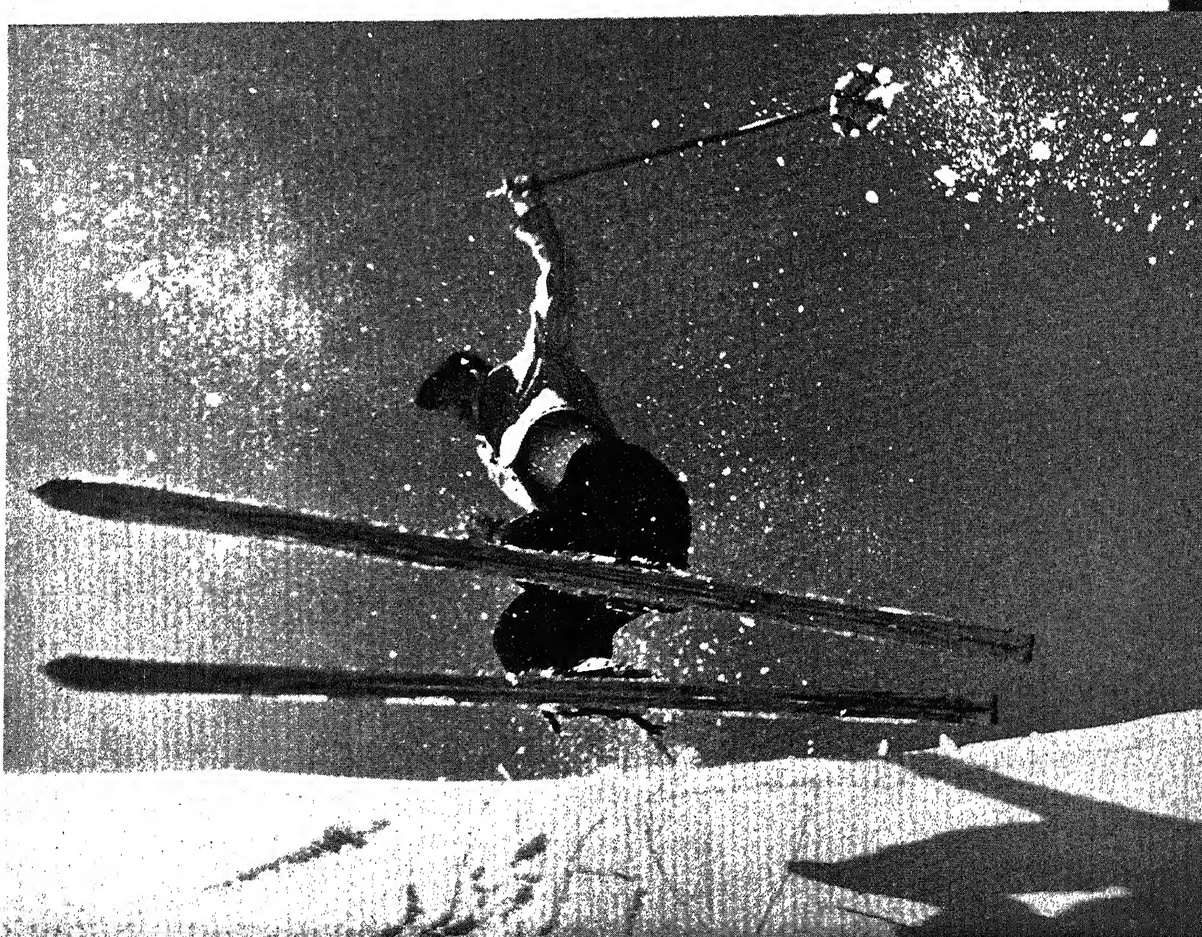
the scene, the victim, the characters involved and anything unusual which figures in the case are the obvious photos to make.

13. WOMAN POISONER. A posed open flash picture using one flashbulb on each side of the face. (Reporters were good enough to hold these extension bulbs.) Skin detail and roundness stand out in this study. This was used on the front page and carried by A.P. Wirephoto. It had such excellent reproduction around the country that the *Journal* received a thank-you letter from the A.P. office. Two flashbulbs, open flash, f:32, Superpan film. Frank Scherschel Photo, *Milwaukee Journal.*

14. MAN STABBED . . . life-saving drama. Police tie a night-stick tourniquet on the stabbed arm of the victim to prevent his bleeding to death. Synchroflash photo, at 8 feet, 1/200 second, f:8, Fast Pan film. William Stahl Photo, N. Y. *Daily Mirror.*



15. This dramatic on-the-spot synchroflash picture shows detective on left holding knife believed to have been used by the man in center as they left the scene of stabbing. William Stahl Photo, *N. Y. Daily Mirror.*



16. OLYMPIC BOB RUN (*top*), Lake Placid, New York. Traveling at 60 miles an hour this bob sled team speeds past the camera . . . snow falling. f:9, 1/1000 second, Super Pan Press film. E. H. Pierson Photo, Lake Placid. New York.
SKI JUMPER (*bottom*). 5 x 7 Series B Graflex, 1/550 second, f:8, K2 filter, Fast Pan film. E. H. Pierson Photo.

Covering Sports

Sports assignments are fun if you like sports. It does take lots of physical effort . . . particularly track meets if they are to be covered event by event.

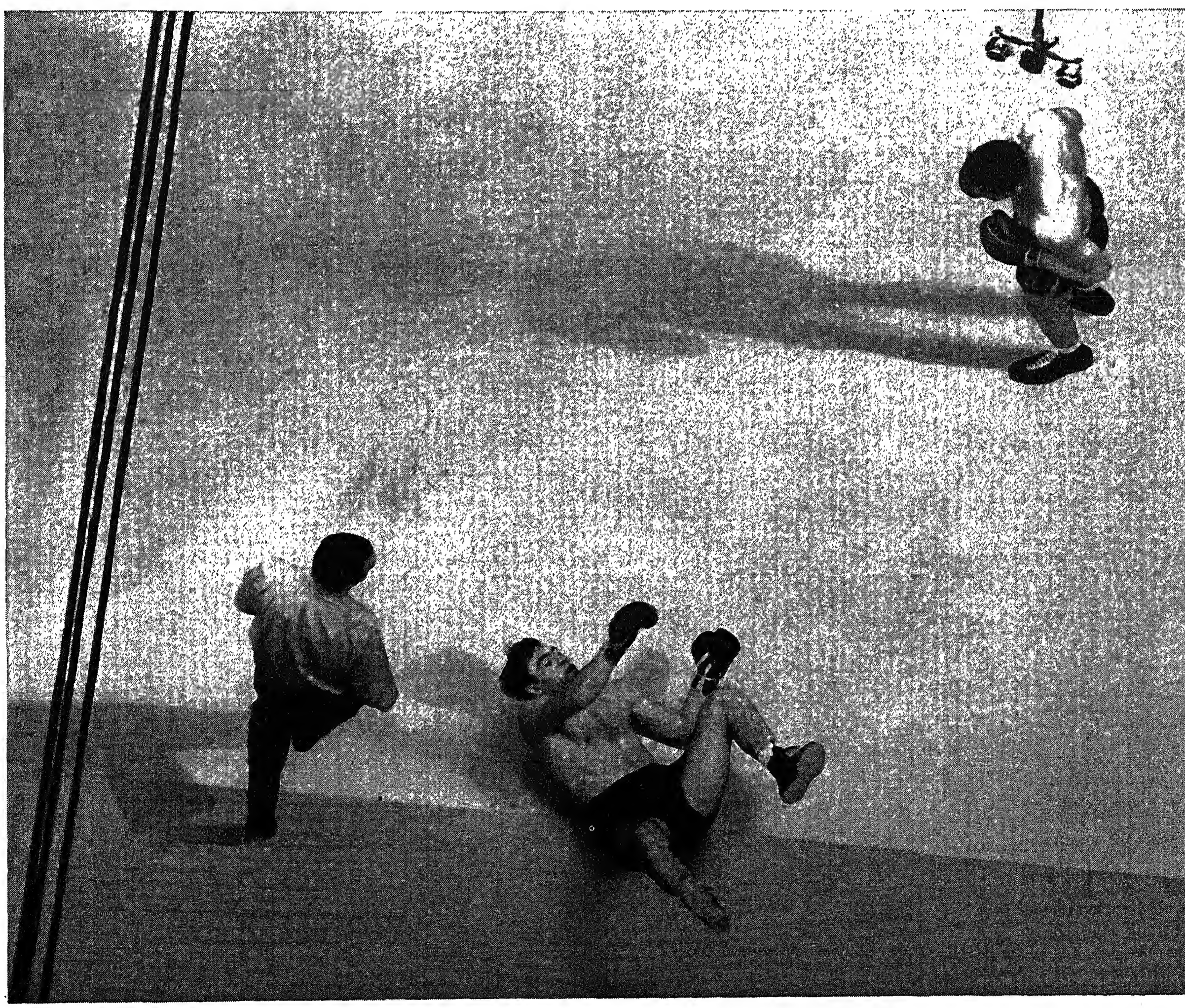
Baseball pictures fall into two classes, those made with a short lens and those made with a telephoto. Whatever the type of lens, the photographer has to show some originality. Anyone can make an "out at first" picture. Most everyone does, particularly when the office demands a first inning photo for an early edition.

The method of coverage with a short lens is personally told by Frank Scherschel to give a more intimate description:

"I make a practice of staying between home plate and first base until a man is on base. I have those two places covered if there is action there. With a man on base, I shift to between third and home. My lens is too short to cover first and second bases, so I concentrate on the batter and on third, keeping my camera focused on the hitter. If he bunts, I have a good action shot of the runner breaking away from the plate and the catcher rushing for the ball. If he singles, I move down toward third to get that active instant when the third baseman reaches for the ball as the runner from first slides in. If the batter hits a long one, I am ready for a play at either third or at home. If instead of a hit, there's an argument at home plate, I am on hand."

Baseball pictures made with a telephoto lens or with the Big Bertha camera from the top of the stands include focusing on second base. That is the spot to train the camera on when there is a man on first in order to picture a steal or a force play.

The neglected part of baseball game coverage is the



17. **DOWN — AND OUT!** Showing use of long focal length lens when covering sport assignments. Photograph taken from ceiling ramp looking down into ring at Madison Square Garden during Mann vs. Louis fight. 4 x 5 Graflex, Zeiss Tessar, 1/120 second, f:4.5, Superpan film, regular fight lights for illumination. Carl Thusgaard, Acme News Pictures.

sidelight photos. They often can tell the story better than an actual play. Why not picture the fan giving the umpire the razzberry? Or when the ball club is being slaughtered, a shot of a bullpen pitcher frantically warming up? How about the "jockies" on the bench? The peanut vendor making a sal- while half-glancing at the playing field?

It takes courage to make that move from the field to the stands because anything can happen in a baseball game. It usually does when you are up in the grandstand making that shot of the frenzied ladies' day rooter. Even when you are on the ground, it happens, too, as you change holders.

The Football Photographer

Football also can be covered from both the ground and the stands. Photography from the sidelines is work, particularly in those punting duels where the play moves from one end of the field to the other. Besides, more than one photographer has been thrown for a loss when a wide end run bowled him over as he tried to find the ball in his Graflex. He endures a constant "down in front" from the stands. He bruises his shins and ruffles his feelings fighting his way through those camera phonies with field passes. He spends a large part of the afternoon looking at the west end of the headlinesman who is facing east.

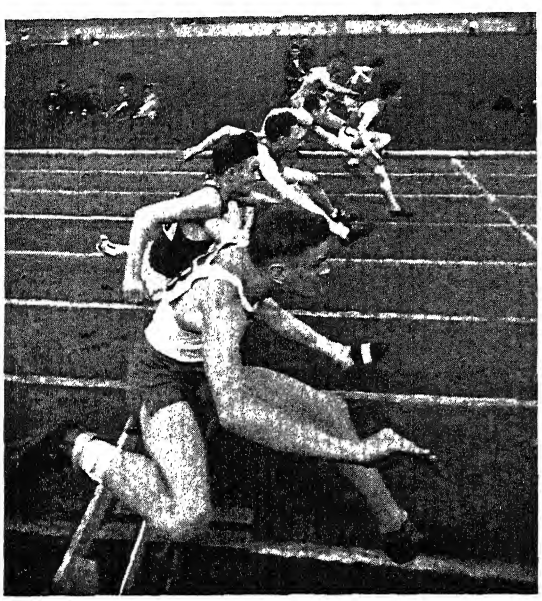
Here's another personal account by Frank Scherschel describing the shooting of football pictures from the ground:

"I like a Graflex with a 12 to 20-inch lens on a 4 x 5-inch film. Football plays usually run towards the widest part of the field open to play. When the ball is close to the sidelines where I am working, the odds are that the play will move away from the camera. That means that a photo will show mainly the backs of the players . . . hardly a lively shot. If the unexpected happens and the play is towards the camera, I am out of luck, because of the long lens. However, on this 'closeup' situation, I concentrate on the start of the play because there may be a fumble which will make a dramatic photo. When the ball is on the far side from where I am working, the chances are that the play will move towards the middle of the field and towards me. With the long lens, I can then get a fair sized image which will stand tremendous enlarging. An f:3.5 lens will permit plenty of speed on those dark days of late November."

From the stands, the long lens camera is trained on the play.

A point to remember is that most football pictures are best when the ball can be found in the photo.

Like baseball, there is room for originality in football pictures. On the *Milwaukee Journal*, we found after looking over the collection of Associated Press Wirephotos of principal games around the country and our own staff shots, that football pictures looked pretty much alike. So for several weeks we devoted sports picture pages to football sidelights. Of course we covered the action on our big game with another man, but in addition we attempted to present football from new angles. One week we concentrated the so-called "rapid action" camera on one vital play and used a dozen pictures of its progress. Another time we did the crowd and its reactions. Then we tried studies of the opposing coaches, the substitutes on the bench and the regiment of players during the warmup. Another time we did the bands, the cheerleaders and the other things and people that helped make the color.

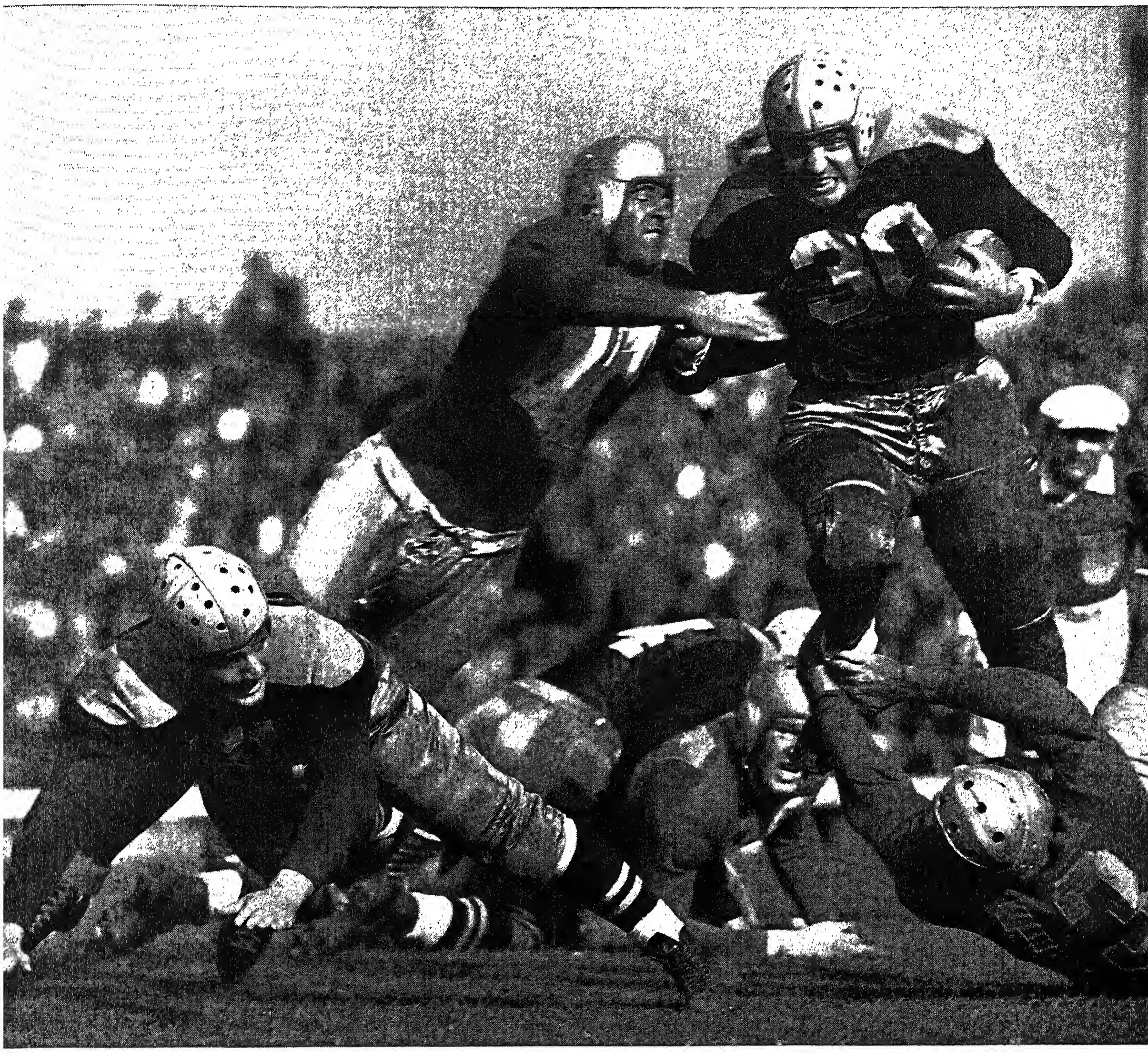


18. HURDLE FINAL. A typical sport assignment which required stopping of action and showing all good detail. Made with extreme wide angle lens, 1/1000 second, f:11, Superpan film. Frank Scherschel Photo, *Milwaukee Journal.*

Track Meets

Track meet coverage calls for a certain routine. Hurdle events are shot at the first barrier because the performers are pretty well bunched at that spot. Dash events and the longer runs are covered at the finish, although the distance runs have to be made early in the race if you wish to show all of the runners. Individual performers are taken in the weight events. Ordinarily the best time to photograph the jumps is after the event because it is a waste of time and film trying to pick a winner from among a dozen or more competitors. Get the winner to make an exhibition jump for form rather than for height. However, outstanding performers sometimes are temperamental boys, so it is wise to take at least one picture during the actual performance. Guard against letting a shoulder or arm hide the athlete's face.

The original slants are a bit scarcer in track meets. There is the picture of the sprinters coming out of the take-off holes, made from the back of the runners. There is the collapse at the finish which every photographer watches for. There is the picture of the behemoth of the discus bent over, watching the officials read the measuring tape. And there is the shot at the finish line of the judges straining to spot the winner breaking the tape.



19. THE MIGHTY HINKLE . . . off-tackle play. Note that this picture was snapped just at the peak of action. Taken during professional football game between Green Bay Packers and Detroit Lions. An excellent use of long focus lens coupled with peak action. 4 x 5 Graflex, 1/1000 second, Superpan film. Fred Stanger Photo, *Milwaukee Journal.*

Basketball

Basketball is the most difficult of sports assignments. The standard picture for a long, long time was the one showing some of the boys leaping for a rebound off the backboard. Now, with the synchronized curtain shutter, floor plays can be photographed, and certainly will be used by editors. Basketball is one sport in which all the action of the game itself has not been photographed again and again. Probably after a few years with the curtain shutter flash, it also will need some originality. Basketball offers another problem: from where to shoot? In football, baseball and track, the crowd is in the stands. In basketball, the spectators flow to the sidelines. Something should be done to aid photographers in covering this sport which is the most widely attended American pastime. It would be wise to give him a front row seat with plenty of elbow room from which to shoot.

As for other sports pictures: do the best you can and the editors will bless you for any originality. Remember, in covering prize fights from the ringside, it takes lots of film and bulbs . . . and luck, too.

The routine picture assignment is the main business of the news photographer. There is the head picture of some visiting luminary, the group of officers a club has

elected, a school project, a building about to be razed, a wrecked automobile, a weather picture . . . and on, and on, and on.

The head picture is something every photographer has to make whether he works in a large or small city. We wish we could say that it is portraiture, but it seldom is. Generally, the limited portable equipment the cameraman carries and the speed at which the picture has to be taken precludes this. However, there are a few hints which should improve the head picture you have to take:

Never have the head face in the same direction as the body. Even the eyes turned from the direction the head faces adds life. Think of the Bertillon photo with the subject's head facing with the body and you see the photo-horror of head and body in a line.

A subject with a hooked or prominent nose photographs best from below. A slim-faced person photographs plumper from above. A round-faced one looks slimmer when lighting is directed across the face.

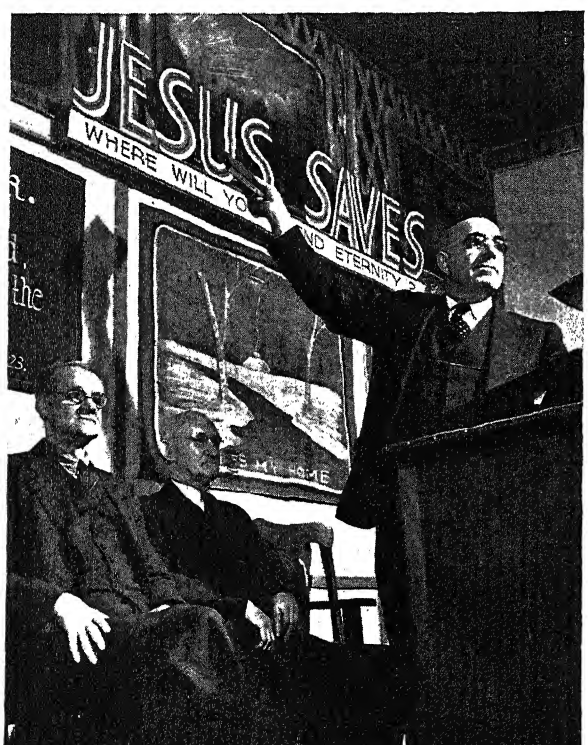
Before you use a flashbulb, look around and see if you cannot make a time exposure. It saves bulbs and frequently results in a more natural lighting.

The smaller the group, the better the picture . . . at least in most cases. The photographer can control the actions of two, three or four persons and mold them into a news picture. But as the group increases, the chances grow that someone will look where he isn't supposed to, generally at the camera.

There frequently is the problem of keeping out some of those on hand for the picture. Photographers used to pose them at the ends and crop them off. But over the years, the public has grown sly. The pests sneak into the center. A good way is to get them to hold extensions and provide other assistance. It keeps them busy and inflates their sense of importance.

The most difficult of all people to deal with (photographically, of course) are the women. And of the women, their club groups are the hardest. The chairman usually insists that everyone get into the picture. She feels they all deserve a pictorial reward for their efforts in blackjacking merchants into giving door prizes, decorating the table or mailing the invitations. It takes a fluent photographer to talk them out of their ideas and to pose them for a picture which will have the greatest reader interest.

Further, as one photographer and one picture editor, we would like to go on record about *That Girl* in the Picture. It looks to us as if the photographer has taken the easiest way out when he has found *That Girl* and



20. JESUS SAVES. This photo made at a revival gives a little variation from the usual group of guest speakers in a fixed row or the shouting-speaker picture. This picture also tells "what and where." Two flashbulbs, one on an extension to right of speaker. Open flash, f:22, Edward Farber Photo, *Milwaukee Journal.*

21. THE RESTLESS FLAME . . . name of the pageant and the cigarette gave some action in the form of smoke. A good example of the candid posed type of picture. The idea was entirely worked out by the cameraman to interpret a local talent play. One bulb open flash on extension, f:32, Superpan film. Frank Scherschel Photo, *Milwaukee Journal.*

22. **GRAIN TRIMMER.** This closeup portrait was made after the worker finished loading a grain boat. An excellent example to show good lighting and a typical newspaper roto assignment. Picture made at night on a dock with light of three flashbulbs. Developed in ABC Pyro. One bulb was in back of the subject to the right, one bulb on left side of the face, and the third bulb at a 45-degree angle from the right front. Open flash, f:32, Frank Scherschel Photo, *Milwaukee Journal.*

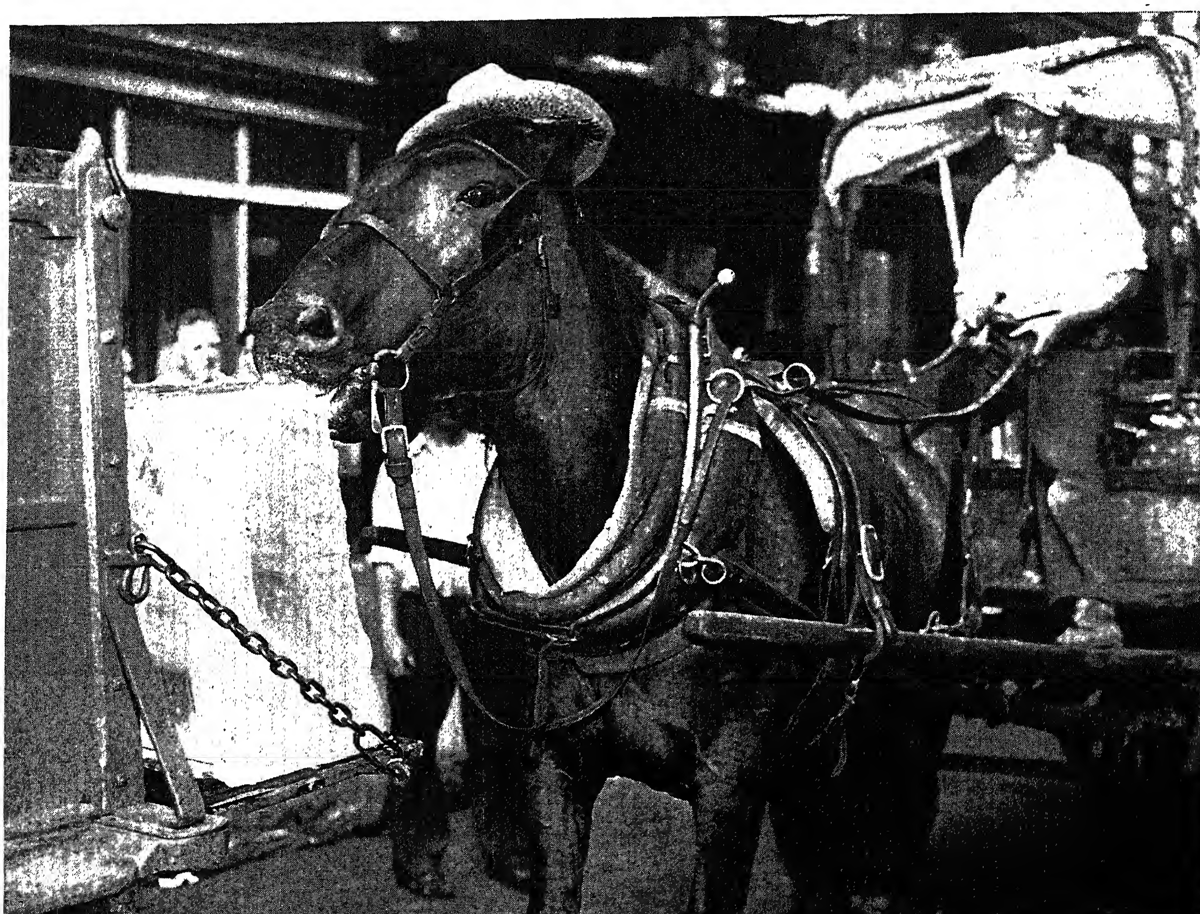
posed her looking at some object or other. Her legs or her figure generally are the center of interest, the object being photographed is secondary. We would prefer to have photographers spend their time concentrating on lighting and closeups instead of finding pretty girls as models.

Some **special assignments** are fun. Others are work.

The society picture has been around a long time and it usually causes the most grief. Most society editors judge pictures by those with the complimentary lighting and retouching of portrait photographers. Newspaper photographers cannot compete with them in the portrait field. But they can more than make up for this deficiency by putting more action and more realism in their photos. Lighting can be improved by the use of extensions. *Milwaukee Journal* photographers carry three extensions with twenty feet of cable on each for society jobs. A good 9-volt battery case is used to fire the flashbulbs simultaneously. The three bulbs can be synchronized for action pictures. The simplest way to use the three lamps is to place one above the camera for a flat lighting and the others on each side or in back of the subject. The lamp above the camera governs the aperture for the picture. The others have no bearing when shooting for coverage of the deepest shadows.

The rotogravure picture permits the photographer real leeway. He can forget where the lighting is coming from and make low key pictures which the fine screen of roto printing picks up. He can remove the bulb from next to the camera and concentrate on sidelights and unusual effects.

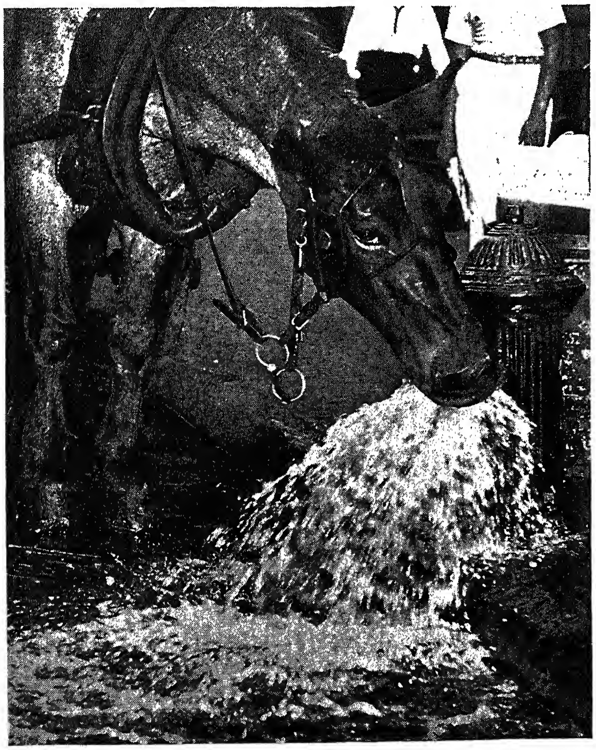
The making of picture stories for rotogravure use is increasing. Picture editors are generally vague about what they want the story to tell. Frequently, the assignment is nothing more than: "Get a layout on how an automobile is made." If nothing else, that lack of specific advice gives the photographer a chance to use his ingenuity. He has to get a mental picture of the story he wants to tell in actual photos and then go to work making them.



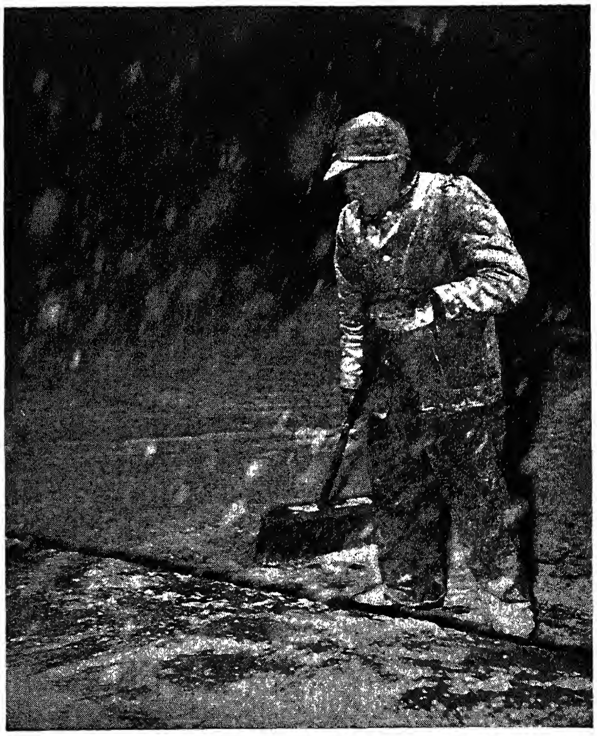
23. FROM HORSE HEAVEN. It was an all-time heat record for a summer day in New York City. So imagine how hot it must have been pulling a junk wagon in the sizzling sun. Jack Cohen's horse pulled up panting in the Manhattan traffic behind an ice wagon. A quick-thinking photographer happened to be out looking for just such a hot weather picture. One bulb synchroflash, 1/200 second, f:8, Fast Pan film. William Stahl Photo, *N. Y. Daily Mirror*.

24. **LOST BABY.** Lost babies are always good for a feature picture. Here is an example of utter exhaustion that is usually a lost baby's lot. Single bulb open flash, f:16, Fast Pan film. Foster Stanfield Photo. *Milwaukee Journal.*

25. **BREATH OF LIFE.** Patrolman McLaughlin shows in this dramatic reenactment how he saved the life of a 5-months-old baby by blowing his breath into the infant's mouth. A second prize photo in *Editor and Publisher's* Second Annual News Photo Contest. Synchroflash, 1/200 second, f:11, Fast Pan film. William Stahl Photo, *N. Y. Daily Mirror.*



26. **A LONG COOL HORSE'S NECK.** Another prize-winning hot weather picture made in New York City. Synchroflash, 1/100 second, f:8, Fast Pan film, distance of 10 feet. William Stahl Photo, *N. Y. Daily Mirror.*



27. **WHEN WINTER COMES.** Seasons of the year are typical assignments. This prize-winning photograph made by Jack Kennedy, Council Bluffs, Iowa. Synchroflash, 1/200 second, f:8, Fast Pan film.

For newspaper fashion pictures, the photographer should depend on action. We believe that these pictures should show a person appearing well and enjoying the clothes he or she is wearing. Newspapers are in the volume business. They have neither the money to spend on expensive models nor the time commercial photographers take to make a shot. So get the subjects in action, acting as if the clothes they wear were theirs.

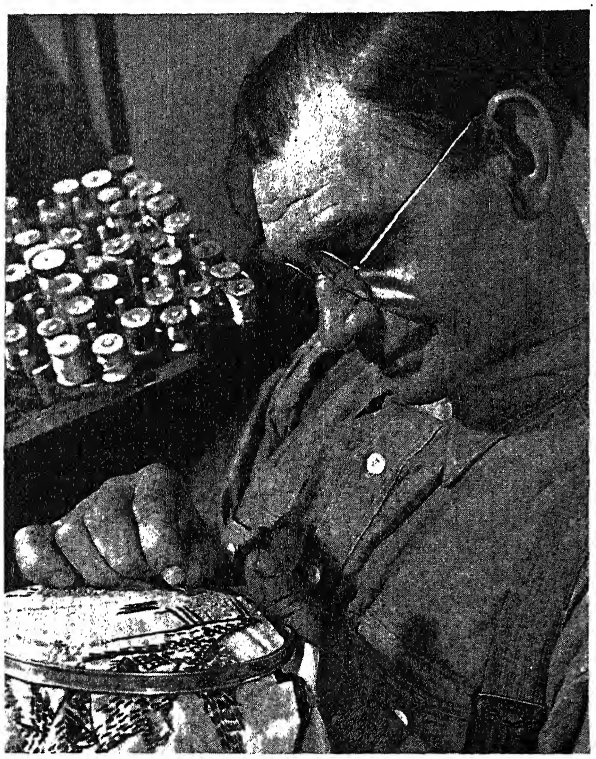
Advertising work is a specialized field that some newspapers expect their photo staffs to know. And many of them get good results. Books have been written on commercial photography and they should be consulted. In brief, a view camera with wide angle lens generally is necessary in making store interiors, showrooms crowded with merchandise, show windows and the buildings themselves. Newspaper photographers hate view cameras as a rule, but if the advertiser is to receive the results he deserves, view cameras must be part of a paper's equipment.

Copying In Newspaper Work

There is one more newspaper photography job — the copying of pictures and drawings. Of course, a copying camera should be available. One particular field of copying is that of hand colored and tinted photographs, which must be printed on white stock for the best engraving results. It seems that researchers in graphic arts films have lagged in film advances, for engravers still use color-blind emulsions and need a white stock for best results. Because of the variety of copying jobs, a wide selection of film is necessary. At the *Milwaukee Journal,* the following films (and their holder markings) are always at hand: process films for architects' drawings, line work and jobs that require great contrast, marked along the holder edge by black paint; panchromatic process film for drawings which need color correction, marked by black and green; commercial films, painted blue; commercial orthochromatic film for normal copies, marked by blue and red; fast orthos, with red; and super pans, green. An Eastman Filter Test Chart is a handy device for showing the best film to use.

Right now is the time to put in a good word for the neglected tripod. It is a well-known geometrical fact that a support at three points means solidity. Yet, we two-legged humans persist in trying to outsteady the tripod. Naturally when covering most sports events and shooting from a ladder or other precarious places, one must take pictures "from off the arm." But whenever and wherever possible, set up a tripod.

And speaking of steadiness, we make the point that we favor shooting at the widest aperture possible. More pictures are fuzzy because of camera movement than because of poor focusing or the wrong guessing of distances. Shoot as fast as possible to cut down the possibility of getting camera movement.



28. W.P.A. FANCY WORKER. Here the photographer has condensed all the important features necessary to tell the story . . . the worker's hand, the spare thread, and the plain clothes and features. Edward Farber Photo, *Milwaukee Journal.*

Processing The Picture

We have seen a number of newspaper plants in big cities and in small ones. We have seen impressive city rooms, the finest of presses in modern quarters, wonderful engraving plants. But as for photographic darkrooms: good ones are few and far between. It seems to be a newspaper practice to squeeze the press darkroom into some out-of-the-way corner.

It is about time that newspaper photographers started a selling job for better quarters to process their pictures. The argument is a simple one: Can anyone expect, or even conceive of, a photographer slaving over a negative and getting the best possible print when he has to work in some closet a janitor has vacated and which reeks with odors and is oppressively hot? Can any newspaper be efficient when it does not give an important department proper facilities in which to turn out work?

The *Milwaukee Journal's* darkrooms are not the most elaborate in the country, but they are efficient and are not old closets. There are two developing rooms and three printing rooms for eleven men. There also is a separate developing room for the color photographer. The *Journal* has four enlargers. Two are Eastman Autofocus enlargers, handling up to 5 x 7-inch negatives, lighted by mercury vapor tubes. They are capable of enlargements to eight diameters. There is a Saltzman enlarger with a universal lens board which permits a variety of lenses to be used in order to make huge enlargements or reductions. There is a Valoy enlarger for 35mm film. A Pako contact printer also is on hand. In addition

29. **A BEAVER TRAGEDY.** Probably one of the first photographs ever taken showing how a beaver met with accidental death after cutting a tree for his dam. A second beaver has attempted to rescue the first one by cutting the tree in half a second time. One flashbulb, 2¼ x 3¼ Speed Graphic, 1/100 second, f:16, Panchro Press film, Ralph Forney Photo.

to the processing room, the *Journal* has a studio and a chemical room.

At the *Journal*, we use stainless steel developing tanks encased by a stainless steel water jacket. These metal tanks are easily heated or cooled to the desired temperature. They are five years old and show no signs of wear. They have held their shape much better than the hard rubber ones formerly used.

Film development is by time and temperature. Because deadlines are always at hand, photographers do not have the time to come in from bright daylight and let their eyes adjust to the dim green light safe for panchromatic film. The time and temperature method has been used by us for five years and it has been successful. Its one failing is that bromide streaks sometimes show in the sky and in the body of pictures. That is because the photographer is too lazy to agitate the film during development and fixing. An agitator for newspaper tanks would prevent this.

The paper to be used to print the picture on is a matter of personal opinion. Glossy, of course, is the newspaper standard. On the *Milwaukee Journal,* we stock the softest and the hardest grades we can buy, favoring no one manufacturer. At the present, the paper cabinets have five grades, dovetailing in degrees of contrast.

No rules can be laid down as to the size to print a picture. You have to know your editor. Most editors work on the theory: how small can this picture run? They invariably make horizontal 8 x 10 photos three columns wide and vertical ones two columns. The smart photographer uses a bit of psychology. He does a selling job by offering his best wares big. He prints his outstanding pictures 10 x 12, 11 x 14 inches and larger. Even the worst picture editors cannot resist these big photos.

Cropping pictures is the story of composition, and long books have been written on that subject. Good photographers instinctively know a good composition and poorer cameramen are aware that their pictures must have a point of central interest.

A word about captioning pictures: the caption is as important as the photo itself. A photographer should train himself to get names spelled correctly, for the cardinal sin on a newspaper is to identify wrongly any person. First names and *all* initials should be listed and most newspapers like addresses and titles as well. Remember, you can never provide too much information about a picture. *Milwaukee Journal* photographers make a practice of picking up programs on the routine events they cover to be turned in with their pictures.

Some newspapers file their negatives. Others do not. On the *Milwaukee Journal,* we file pictures only, although photographers personally keep their best negatives. The others are disposed of after three weeks. There are arguments both for and against the filing of negatives instead of pictures. From the photographer's viewpoint, the saving of photographs is preferred . . . he doesn't have to make new prints. The library backs him up. It is less work because the insertion of the film in glassine envelopes is long and tedious. Photos also can be more roughly treated than negatives. Against them are the picture editors, who often find faded photographs which did not visit the hypo or wash long enough when made, who have found groups hacked apart when they wanted to run them together, and who favor the uniformity of size in filing.

Today's Photographer

At various places we have pointed out that today's news photographer is not an automaton who clicks the shutter on his camera. We have tried to say that he must differentiate between snapshooting and making his pictures tell their stories. His is the responsibility of being the interpreter of the scene.

In order to fulfill that responsibility, he has to keep up with the trends. Not only is he expected to keep abreast technically, but he must know the current tastes in pictures. A few years ago it was pictorially smart to show people with their mouths stuffed with food. That is poor taste today. A few years ago it was extremely stylish to lie on the ground and shoot up at a baseball pitcher faking a windup and lifting his leg high in the air. That is pretty corny today.

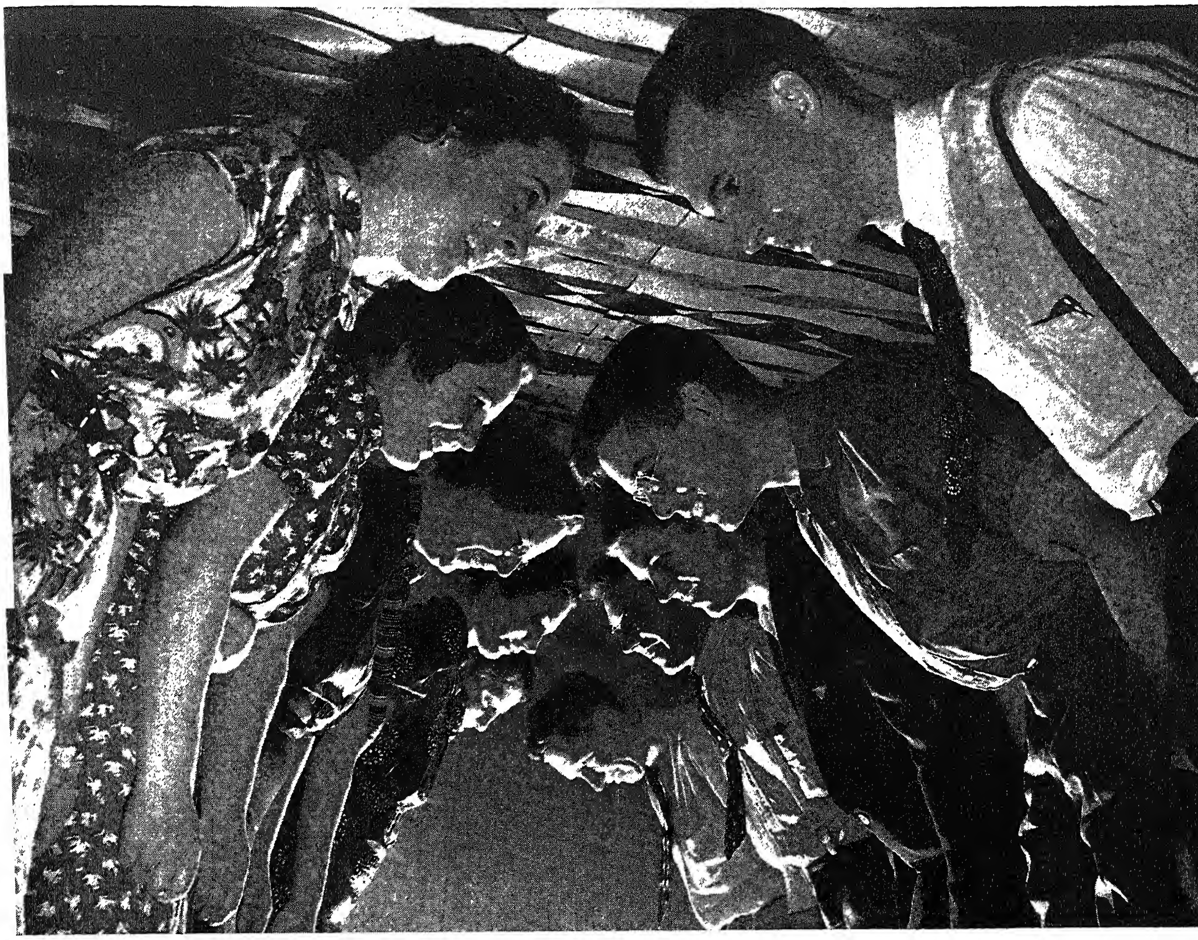
Today's photographer must also be a student of pictures. He should be conducting private research of his own by experimenting with new photographic angles and slants. He should study other newspapers to see if new slants are being tried, and he should study the picture magazines for ideas.

He should keep step with the frequent surveys made as to reader interest in pictures. An important survey by Jack M. Willem found that a picture of one person does not have the attention-getting value of a man and a woman together. Now add a child along with some dramatic news angle and the interest is at its peak for this photo.

Another startling fact this survey disclosed is that sport pictures rank quite low as far as general reader interest is concerned. The thing that saves many of them is that they usually are full of action, which increases the interest by fifty per cent.

Full length pictures, according to the researchers, are better than head photos, particularly of women, for their reading sisters like to inspect the clothes they wear.

Mr. Willem also says: "Reader interest figures indicate the daily press would do well to adopt a pictorial policy apart from the established obligation of newspapers to be timely in their treatment of news events. From the standpoint of the reader, there are far too many pictures of persons in the news, of personalities and sports. Women readers favor pictures of children far in excess of any other type. Men readers prefer pictures of places and objects in the news." See the special chapter on Reader Interest In News Pictures in this book for further details.



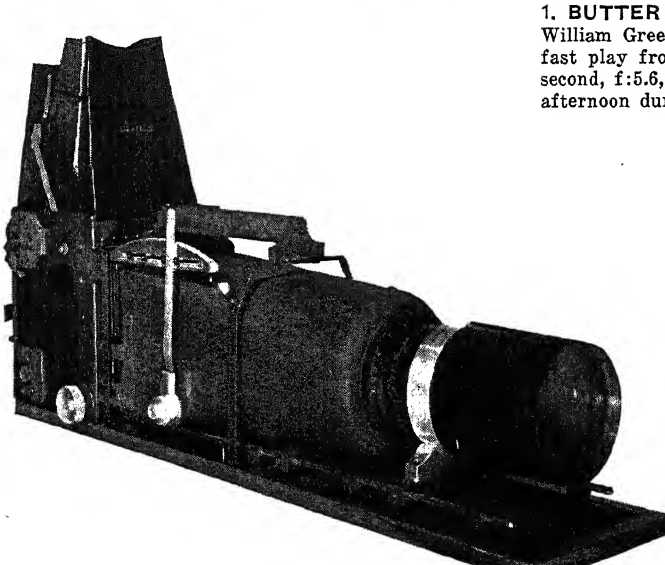
30. DO-SI-DO. An interesting angle shot to interpret a barn dance. This picture was prearranged and made with two flashbulbs — one on the floor in the rear, and one next to the camera. f/32, Fast Pan film. Frank Scherschel Photo, *Milwaukee Journal.*

Tomorrow's Photographer

The photographer of today is doing a pretty good job. The man of tomorrow will probably do a better one. There will be film, camera and other technical improvements. There also will be improvements in technique. And in technique will lie photography's greatest gains, for no matter how good the equipment, pictures cannot improve unless the man behind the camera learns to make better photographs. We believe that the breeding ground of this improved technique is the small-town newspaper, because, as we have pointed out, the photographer there has the opportunity to experiment in method which the man in the metropolis does not have. In addition, many photographers in the smaller cities are learning engraving and printing technique, which will show them how best to make photographs for reproduction. And, after all, the finished result that the public sees is what matters.

Now, one last word. In all this business of news and press photography, the one branch that is not being developed is the editing. It is the editor who makes the photographer look good or bad in public print. Perhaps the time is not far distant when young journalists will train in the field of picture editing. Then they will have at least a casual acquaintance with the use of pictures editorially . . . recognize the important pictures to make six columns wide and the ones to make two in their local newspaper.

1. **BUTTER FINGERS.** With the 5 x 7 Big Bertha Graflex, William Greene of the *New York World-Telegram* catches this fast play from the press box 110 feet from the action. 1/410 second, f:5.6, 28-inch lens, Fast Pan film. Photo taken in late afternoon during light rain.



2. **BIG BERTHA CAMERA.** The 5 x 7 inch Home Portrait Graflex camera is shown equipped with a 40-inch f:8 Dallmeyer telephoto lens. Note shift lever with special stops for focusing.

PHOTOGRAPHY WITH SPECIAL CAMERAS

J. A. SPRAGUE

The long-range telephoto camera, as shown in the accompanying illustrations, usually called the "Big Bertha" or the "Long Tom," is in daily use by well-equipped newspapers and photo syndicates throughout the nation. This camera is used for photographing distant objects of all kinds when closer working distances would be disadvantageous from some standpoint such as perspective or where working locations nearer the subject would be inconvenient to occupy or are actually unavailable. Whether it be distant shots of sports events or of a window jumper, bridge jumper, or flag pole sitter, the Big Bertha "reaches out" for "close-ups" when the photographer can't get close.

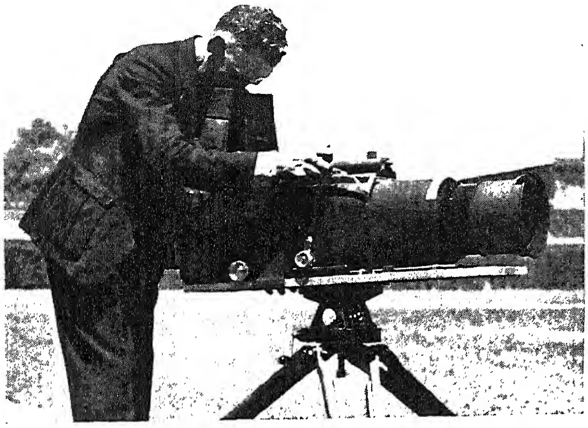
To handle this long-range shooting, the modern, well-equipped newspaper may have a variety of long focal length lenses ranging from 17 to 40-inch focal lengths, each used in covering assignments for which it is best suited. Invariably these lenses are used with Graflex and Speed Graphic cameras either of the 4 x 5 or 5 x 7 size, depending on the lens used or the preferences of the user . . . most of them permanently *built-into* the camera. The most popular lenses in use are the 17-inch f:4.5 and f:5.6 Dallmeyer telephoto, the 20-inch f:4.5 Bausch & Lomb and Zeiss Tessars, the 28-inch f:5 Zeiss Triplet, and the 40-inch f:8 Dallmeyer telephoto. Even a 60-inch f:8 Dallmeyer telephoto lens has recently been supplied and especially fitted to a 5 x 7 Graflex camera . . . for the Associated Press. This combination is, however, an exception, but was believed necessary for certain types of work, and since its completion it has proven to be a very valuable addition to that great syndicate's fine equipment.

As stated, most long focus lenses used by newspapers are permanently built into the Graflex or Graphic camera used with it. A stock camera is used, but each mounting job is handled on a custom basis so that nearly any desired combination can be obtained from the Graflex factory. In the building up of a camera of the Big Bertha type, great care must be taken to obtain rigid mounting of the lens to the camera. This will insure permanent alignment, ease of operation, reduce back lash in the gear-shift mechanism to a minimum, and at the same time provide a combination sufficiently strong to take the "bangs" that are unavoidable in both the transportation and actual use of the camera.

The "gear-shift" model of the Big Bertha referred to was first developed for the *New York Daily News* with the cooperation of George Schmidt of the *Daily News* Photo Laboratory. Since that time (1937) it has been constantly improved until today it is accepted by most of the syndicates and larger newspapers as essential. Mr. Schmidt believed that more good pictures would be made if the photographer were equipped with a camera having a pre-focusing device, one that could be pre-focused by the operator to desired distances before an event began, and thereafter be shifted with speed and certainty to any of the pre-focused positions.

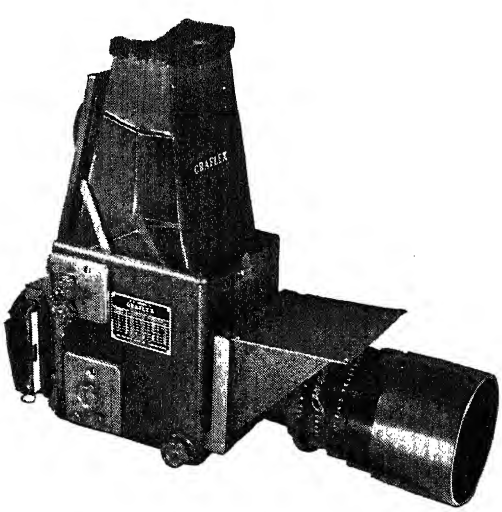
Consider a situation, for example, where the photographer has figured the next picture to be at home plate and has his camera so set when a double play gets under way and the action is at third base instead of at home plate. For him to locate the image on the ground glass and re-focus on third base visually in the split second that is available would be very difficult, to say the least. With the pre-focus gear-shift equipped camera, the shift back to the desired position is but a single mechanical movement that requires almost no time . . . and frequently outstanding negatives are sent in which otherwise could not have been made. The convenience of the shift can readily be visualized.

The news boys long ago learned the value of the Big Bertha camera in covering sports events from the grandstand. It matters not what the sport . . . baseball, football, tennis, horse racing, track or prize fights. Better and more negatives can be made by a photographer located in a choice position with a perfect view of the entire field of action than can be made by a man working on the field, trying to guess where the next play will take place. Shooting from a distance avoids possible interference with the game and annoyance to spectators, as well as the actual danger of personal injury involved. For instance, many a photographer has been "beaned" by a line drive down the first or third base line as he covered the attendant action from the sideline.



3. **BIG BERTHA IN ACTION.** Swain Scalf, *Chicago Tribune* Staff Photographer, swings his camera into action for telephoto news work.

The Big Bertha has definite advantages for the covering of each different type of sport. For example, in covering baseball, it is possible to *really "cover"* both second base and shortstop . . . an area of the diamond otherwise almost out of reach of the press photographer. Baseball followers know many thrilling plays take place at these positions. Until the availability of the Big Bertha, few sports page addicts shared these bits of baseball action. Another interesting setup for baseball coverage is that of shooting "run-ups" that take in *both bases.* By so placing the camera that it covers first base, the second base line and second base . . . and having pre-focused it on the two bases and possibly on a midway point, some unusual "shots" are sure to result. This type of shot, which can be mighty interesting, gives the art director an opportunity to vary his layouts by occasionally using a long narrow picture.



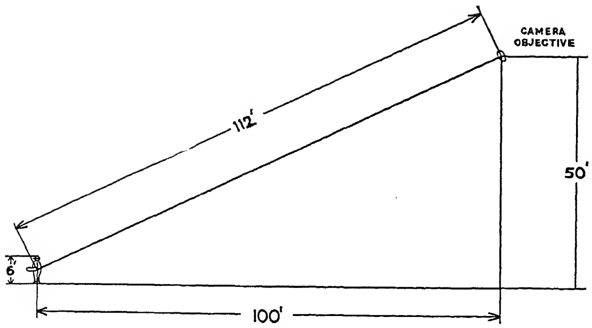
4. 4 x 5 R. B. Series B Graflex equipped with a 17-inch Dallmeyer telephoto lens for medium distance photos.

The question has often come up: why not use a small camera with a telephoto lens and reduce the weight and bulk of the equipment? While there are plenty of examples of unusually fine distance shots made with small cameras, the small films call for special handling that suits them only for special news assignments on most papers. For all-around work, the larger cameras continue to get the call. When it is considered that newsmen have dead-lines to meet, and rapid developing and wet printing is the rule; and when one remembers that the picture editor frequently calls for a sharp "blow-up" to run about four columns or more, with characters $4\frac{1}{2}$ inches or more in height; then it will be appreciated by those who have tried both that a large negative image in the first place is desirable if not essential. For instance, if a camera equipped with a lens of 5-inch focal length is used to photograph a 6-foot subject from an elevation of approximately 50 feet and a distance of 200 feet, a negative image approximately $\frac{1}{8}$ inch in height will be obtained. The same setup photographed with a 28-inch or 40-inch lens would yield a $\frac{3}{4}$ or 1-1/16-inch image respectively. Even at a distance of 400 feet, the image size obtained with the 28-inch lens would be $\frac{3}{8}$ inches; and, with the 40-inch lens, 17/32 inch. Where distances of 100 to 400 feet must be spanned, it is easy to see that the 28- and 40-inch lenses are both practical and essential. The fact that the larger cameras invariably provide for the use of individual film holders is another valuable advantage to the paper. So equipped, the photographer can send individual exposed negatives back to the office by messenger immediately after making the exposures, thereby gaining quicker development and making earlier editions with no loss of time or film.

The foregoing has been an attempt to describe briefly *what* the Big Bertha camera is and *how* it serves. Since a stock camera is usually used, the question to be decided being that of *what lens* to have mounted to the camera, the accompanying Figure 5 may be of value. Based on the photography of a 6-foot subject, with camera positioned at an elevation of 50 feet above and at a distance of 100 feet from the subject (in the press box of a stadium, for example) it discloses the negative image size that lenses of different focal lengths will obtain. And, after all, it is the resulting negative image size that counts in press photography . . . since anything can happen while on assignment, and any picture brought in may be the one chosen for the feature "blow-up."

Ringside Camera

The Ringside camera, often referred to as the Super-Sports camera, was designed for photographing action under poor light conditions or where the use of flash-bulbs is not practical or permissible. It is generally used to "cover" championship fights, hockey, basketball,



5. Diagram showing position of Big Bertha camera in relation to the subject to be photographed. Full explanation of this drawing is given in the column at the left.

courtroom scenes . . . and, frequently, football games from the sidelines when the light is poor.

The lens equipment will vary from f/1.8 to the f/3.5 objectives in focusing mounts, while the camera is almost invariably a 4 x 5 Speed Graphic especially converted to this purpose. Lenses of such focal lengths and speeds — and particularly the f/1.8 lens—are very critical as to focus. This is an unalterable law of optics. Therefore, the camera should be handled by one who is expert at judging distances.

To assist the operator in setting the lens to the desired distance, a focusing ring with large visible distance numbers is provided. The arrangement is such as to permit the operator to change the focus of the lens without removing the camera from the eye, thus making it possible to compensate for changes in the subject distance. Without this provision it would be very difficult to follow focus as the locations of the action change so rapidly that time would not be available to permit turning the camera up while small numbers at the front of the camera were consulted and reset.

In use the usual procedure is to predetermine the distances to various points about the ring or hockey rink or wherever the action is to take place before the activity gets under way, fixing those distances in mind. During the action the camera operator can then follow the subjects, moving the footage ring accordingly to the proper markings for the positions, the distances to which were previously determined.

If you are among the fortunates who can shoot flashbulbs at all events you have no need for these ultra highspeed lenses. But for those who cannot, the highspeed lens is indispensable. In fact, it became a necessity in some of the larger cities where from ten to twenty photographers might normally be expected to cover an event and where the simultaneous release of flashbulbs by all of them at one time might reasonably momentarily blind the contestant facing the camera or otherwise interfere with the sport or game. Where such conditions exist, the exhibitors have usually cooperated by furnishing sufficient light to permit the satisfactory use of the Ringside camera—although, I have seen some fight rings and hockey pens that would hardly fog a negative with the lensboard out if sufficient shutter speed were used to stop the action.

An adaptation of this same type of camera is extremely handy where flashbulbs can be used without restriction. It is the same unit but equipped with an f/3.5 lens and especially outfitted with built-in focal plane shutter flash synchronization. This job is valuable for covering any kind of sporting event at night where fast action is encountered—such as football, basketball, track, midget automobile racing, etc. Especially valuable is this combination since the appearance of the long peak flashbulbs which makes it possible for the photographer to arrest action through the use of focal plane shutter speeds that would be far beyond the ability of the between-the-lens type of shutter to catch.

6. **RINGSIDE CAMERA.** This camera uses just the rear focal plane shutter and is very similar to the regular Speed Graphic model in operation. A large focusing ring permits quick change of distances to fast sporting action within comparatively close quarters.

CROWD INTEREST . . . the great challenge to every photographer. Here we see the general mass view. How many people in the above scene would be interested in your own pictures? What makes them stop or pass on? How can you as a photographer make your own work carry greater reader interest? Turn to the following chapter for these important answers. You will also find many new facts about pictures and how the public reacts to them. Photo by R. I. Nesmith.

READER INTEREST IN NEWS PICTURES

JACK M. WILLEM

The average newspaper reader cares little or nothing about the techniques of news gathering, news photography, and reproduction, and knows only what appeals to him sufficiently to cause his eye to pause and his mind to record.

I give you the reader's point of view on news pictures . . . a point of view which has been gathered and measured exclusively over an eight-year period under the assumption that the only sound test of the interest of a reader is what he actually looks at or reads.

Point of view, as we all know, makes a tremendous difference in the interpretation of facts.

Publishers publish daily not because they are merely philanthropic and have a social obligation to do so, but because the people in their cities want daily to read the news, the pictures, and the features which the publishers are in a position to give to them.

The changing scene for the dissemination of news and entertainment no longer makes these men and women reliant solely upon the newspaper. Thirty years ago there were relatively few sources; today there are many. Thirty years ago publishers gave readers what the publishers thought they should have. Today, with the newspaper's very existence predicated upon reader interest, publishers are finding that they must give what the majority want—and in a manner to which the majority are being accustomed.

This is true not only in the field of journalism, but in countless other fields as well. In department store operation, for example, buyers no longer are sent out to buy what they think will sell, but what their salesmen, because of intimate contact with the public, KNOW will sell.

Hence the point of view which cannot possibly be overlooked today is the reader's point of view.

No matter how perfectly the photographer practices his art; no matter how perfect the mechanics of his print; unless his picture attracts the eye of the newspaper reader, it, like the flower of Thomas Gray, will waste its perfection on desert air.

On the great majority of papers, the press photographer does not yet enjoy the distinction of the by-line reporter, the featured columnist, the political cartoonist, or the comic strip artist. Whereas a certain percentage of newspaper readers will buy a newspaper because of any one, or a combination of the headliners mentioned, the situation is unique when a reader will buy a newspaper because of a given photographer or a given picture.

In fact, so little is known about the value of pictures, and the means by which they can be used to increase the effectiveness of a newspaper as an instrument of public influence and as an advertising medium, that much of the money now invested is being wasted.

In the field of daily journalism, one of the most striking developments of the past five years has been the tremendous increase in the use of pictures.

Use, by metropolitan dailies, has increased 57 per cent since 1931 and 10 per cent since 1937. The average number of pictures per daily metropolitan issue is now 38 as against 32 in 1937 and only 23 in 1931. More metropolitan papers added picture pages in 1938 than in any other single year.

Smaller dailies—those below 30,000 and averaging around 14,000 circulation—have kept the pace. While averaging only 14 pictures per daily issue, the picture-per-page average is now 1.15 as against 1.34 for the metropolitan daily.

Only weeklies remain deficient. They average five pictures per issue—against 14 for the small daily—and have a picture-per-page average of much less than one.

Today, with picture consciousness of the public at perhaps an all-time peak, due to increased displays by newspapers, and in part to the rise of the dozen or more photo magazines, United States and Canadian newspapers are spending around $8,000,000 annually to picture the events they report.

Increased use of pictures by 57 per cent and the outlay of over $8,000,000 are the reply of the daily press to public demand for pictorial treatment of the news.

The question now arises—how strong is this reply? Are newspapers, even with increased use and expanding budgets for photographic reproduction, meeting public demand? And are they doing so economically?

Today's Picture Editor

In the editorial rooms are men whose business it is to see that the columns of their newspapers are illustrated. It is the business of these men to instruct photographers and assign them to news and feature stories which they believe are worth illustrating. It is their business to select pictures from those submitted by the news picture syndicates; to select from the morgues pictures which are best adapted to the story which is to be illustrated; and to see that pictures are printed which will be seen by the public which buys the paper.

Among these men one might expect to find some unanimity of opinion on the appeal of pictures of certain types. Yet repeated surveys of these men discover such widespread differences of opinion, that the only conclusion to be drawn is that men who should agree are in total disagreement.

A minority of papers have picture editors, and the qualifications of many of the men enjoying the title are open to question. On most papers, a wide variety of editors all have a hand in selecting the pictures which appear in print from day to day.

The great majority of these men work on the theory that readers see every picture on a picture page, and all of the pictures appearing through run of paper.

All of this suggests waste—waste beginning with the knowledge that of all pictures taken for newspaper use, less than half find their way into print.

Waste begins with the photographer, who must, for lack of greater knowledge, take many more shots than are required for the assignment.

Because many of the men in charge of news picture selection do not agree on types which will attract reader interest, and select prints solely on the basis of personal interest, intuition, hunch, or what is commonly known as a sixth "news" sense, waste again looms up.

And because these men almost universally work on the assumption that all pictures published will be seen by all readers, there is still greater waste.

The purpose of the picture studies made over an eight-year period, which cover the habits of 9,000 men and women and the treatment of over 20,000 news pictures, is to eliminate the majority of this waste—to provide a reliable index of picture interest. This index is based on figures which have been gathered through reader studies by the Gallup reader-recall method.

It is one thing to operate on the broad theory that "everyone looks at pictures" and simply increase the use of those pictures which will be seen by the majority of readers.

To satisfy public demand for pictorial treatment, the daily press has not gone beyond a general increase in the total number of pictures published and the appropriation of larger funds for darkroom and engraving equipment.

Picture Survey Results

As proof of this statement I cite results of annual studies conducted since 1931. From 1931 through 1938, pictures of children have never been in excess of 4% of all pictures published. Pictures of places or objects in the news have never been in excess of 5% of all pictures printed.

Pictures of persons in the news, of personalities, and of sports have accounted for better than 70% of all pictures published each year since 1931. Historical pictures, pictures of scenery or travel, of animals, of science and industry, all have consistently remained below 5%.

Local pictures in metropolitan dailies have been consistently around 60% each year. Pictures of persons showing men only are still between 50% and 60%.

To completely satisfy public demand and interest, the daily press must carefully analyze its distribution of pictures by classification and type, and begin to reapportion these types in line with reader interest.

Readers do not see every picture published in a newspaper, and neither do they see every picture published on a picture page.

By some subconscious process, governed by the manner in which the human eye travels across the printed page, and the natural interests of the observer, the reader sees and remembers pictures of various types to certain relative degrees. His natural interests are touched faster when the eye transmits a familiar message to the brain, and these interests telegraph the eye to stop. The reader literally chooses his pictures.

The picture page itself, as a whole, attracts the greatest number of readers of a newspaper—as you know. On an average day, 84% of the men and 90% of the women readers of a daily see something on the picture page.

Yet, of all pictures appearing on a picture page, only 75% will be seen. One out of four is unable to attract a reader. Women are more thorough **observers** of a picture page than are men, but men are more thorough **readers** of the picture page. That is to say men are more apt to read the cut-line under the pictures on a picture page than are women.

Of pictures appearing through run of paper, only 40% will be seen in the average issue by the average reader, with women seeing more pictures than men.

The most promising and important page in a newspaper, from many standards, is Page 1. Dr. Gallup's surveys have shown, however, that the average banner story on page 1 is read by only 47% of the men and 41% of the women. My picture studies show that the average picture on page 1 does comparatively little better. It is seen, on the average, by 61% of the men and 58% of the women. As you see, by these figures, men are better readers and observers of Page 1 than are women.

These statistics are sufficient to indicate that mere publication of pictures does not insure their being seen by 100% of the paper's readers; that readers consciously or subconsciously choose their pictures; and that here alone is wasted some of the money now invested.

Survey Variations

Let me caution you to remember, before proceeding, that many of the figures which follow are averages based upon interviews with over 9,000 men and women in 15 cities. Individual city and publication results will vary from the average.

To show you how individual situations vary, let me quote some figures from the last annual study of news picture treatment. During the identical week in 1938, the Des Moines *Tribune* published 380 pictures, the Cleveland *Plain Dealer* 196, and the Memphis *Commercial Appeal* only 89.

Total pictures published per week is not an accurate rule, however, since many papers are physically handicapped by lack of pages. A more accurate measure is the picture-per-page average. How this latter measure balances factors is indicated by the case of the two papers in Toledo—the *Times* and the *Blade*. During the same week the *Times* used 191 pictures to 371 for the *Blade*. The *Times*, however, averaged 2.0 pictures per page, while the *Blade*, with more pages, averaged 1.8 pictures per page.

Percentages of Reader Interest

But to return to the matter of reader interest. I am now going to show you the percentages of reader interest in various types of news pictures—proving first, that no pictures are seen by 100% of all readers; second, that there are certain types and classifications which will attract more readers than others; and third, **that there is need for the establishment of pictorial policies apart from the established obligation of the press to be timely in its treatment of events.**

On this first, Chart IA, is recorded the percentage of reader interest in each of thirteen major classifications —classifications which cover all pictures appearing in daily newspapers.

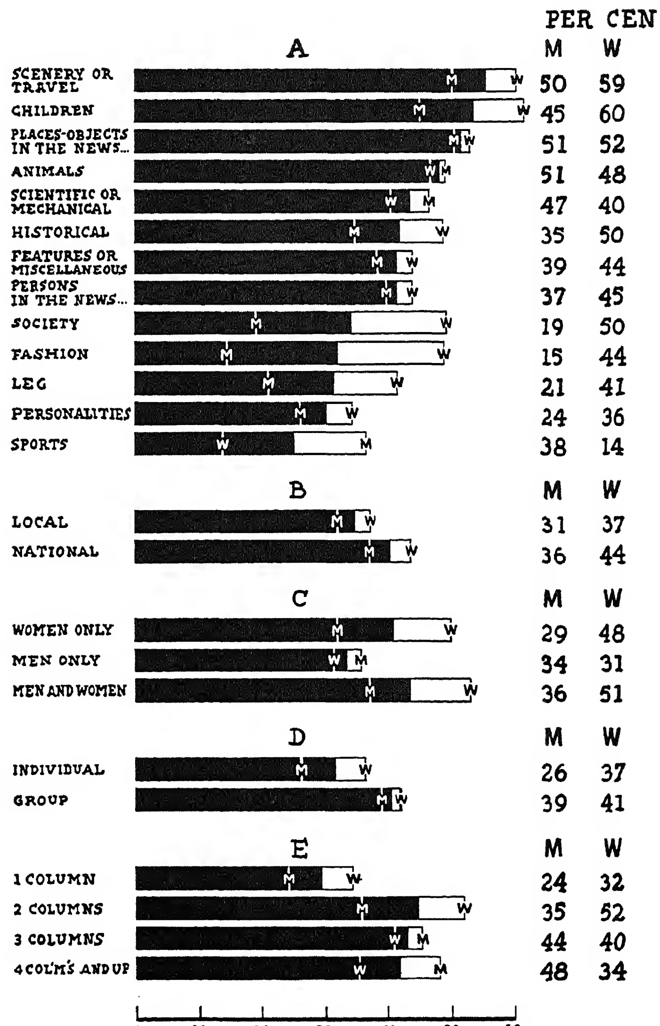
These classifications are self-explanatory, with perhaps but one exception.

If a picture of Hedy LaMarr is shown in connection with a news event, the picture falls in the "Persons in the News" classification. If, however, Miss LaMarr is shown picking flowers in the back yard of her home, and the caption has no specific news value, the print falls in the "Personality" classification. Many straight publicity photos, prints of persons in attendance at conventions, and pictures of more or less prominent persons snapped in so-called "characteristic" poses fall into the "Personality" classification.

The horizontal bars represent the composite interest of men and women in the classifications which they are opposite. The figures in the columns to the right are the percentages of reader interest in pictures of the classifications listed. The first column shows the picture interest percentage for men readers; the second for women readers; and the third is the composite percentage. The "Ms" and the "Ws" on the horizontal bar line permit a graphic picture of the relative interest of men and women readers as against the average.

The classification which has the highest percentage of reader interest is that of Scenery or Travel. Interest of women in pictures of this type is greater than that of men.

Second longest bar on the chart is that opposite pictures of Children. Interest of women is again greater than that of men, with the women's figure higher than for any other on the chart. Interest of men is consider-



READER INTEREST IN NEWSPICTURES..
W-WOMEN M-MEN C-COMPOSITE

CHART NO. I. This chart shows the comparative reader interest in news pictures for men and women. Fully described in the text.

ably lower, however. Little need to suggest that the reason for this female interest in pictures of children is the maternal instinct inherent in every woman.

The length of the third longest bar substantiates the length of the longest bar. In all of us there is a strong desire to see pictures of places where we have been, or would like to be. Hence strong reader interest in pictures of Scenery or Travel, and in pictures of Places or Objects in the News.

Some of the classifications run true to form, or along lines you would naturally expect. Men are far more interested in sports pictures than are women, and women are far more interested in pictures of society and of fashion than are men.

Several other classifications afford surprises. Interest of women in pictures pertaining to science and mechanics is close to that of men, and the interest of both men and women in pictures of animals is almost identical. Animal pictures are fourth in reader interest.

Most surprising revelation is that leg pictures, "cheesecake" pictures, or "sex" pictures—whatever you choose to call them—are seen by almost twice as many women readers as men. In this modern age, sex is no longer a novelty. More exposed limbs are seen on the street and at any social gathering than can ever find their pictorial way into the daily press. The high interest of women in leg pictures was most neatly explained by the stenographer who said, "Humph! That's simple. We like to see what, if anything, some other woman has that we haven't got!" High interest of women in pictures of other women is confirmed and shown by a later breakdown.

2. THE HISTORICAL PICTURE. The first Baptist Church in America, Providence, R. I., founded in 1638. The present building was erected in 1775. Harry A. Scheer Photo.

Historical Pictures

A type of picture which affords excellent possibilities from the standpoint of reader interest is the Historical picture. Pictures of this classification rank sixth in interest; attract 50% of the women readers of a paper. Pictures of your city back in the 80's; a "traffic jam" of the 90's at Fourth and Main; the old Volunteer Fire Department, and so on. Morgues are a veritable gold mine. For years newspapers have published briefs from the files of 10, 25, and 50 years ago. Yet few have capitalized on reader interest by doing so pictorially. Pictures of Persons in the News tie for seventh in reader interest, ranking even with the "Feature or Miscellaneous" group. Pictures of Personalities rank next to last.

Five of the six classifications with greater picture interest than that in Persons in the News include pictures for which timeliness is not necessarily an asset. This strongly indicates that the daily press would do well to establish a pictorial policy apart from its established obligation to be timely in treatment of events.

There are other factors influencing picture interest over and above major subject classification.

The first additional factor to consider is whether the subject matter is local or national. Here, Chart IB, the horizontal bars indicate the relative reader interest in local pictures as against national. That national photos have higher reader interest than local is generally surprising to most newspaper men. The spread is not great. leading to the general conclusion that the picture itself counts most, not whether it was taken locally or nationally.

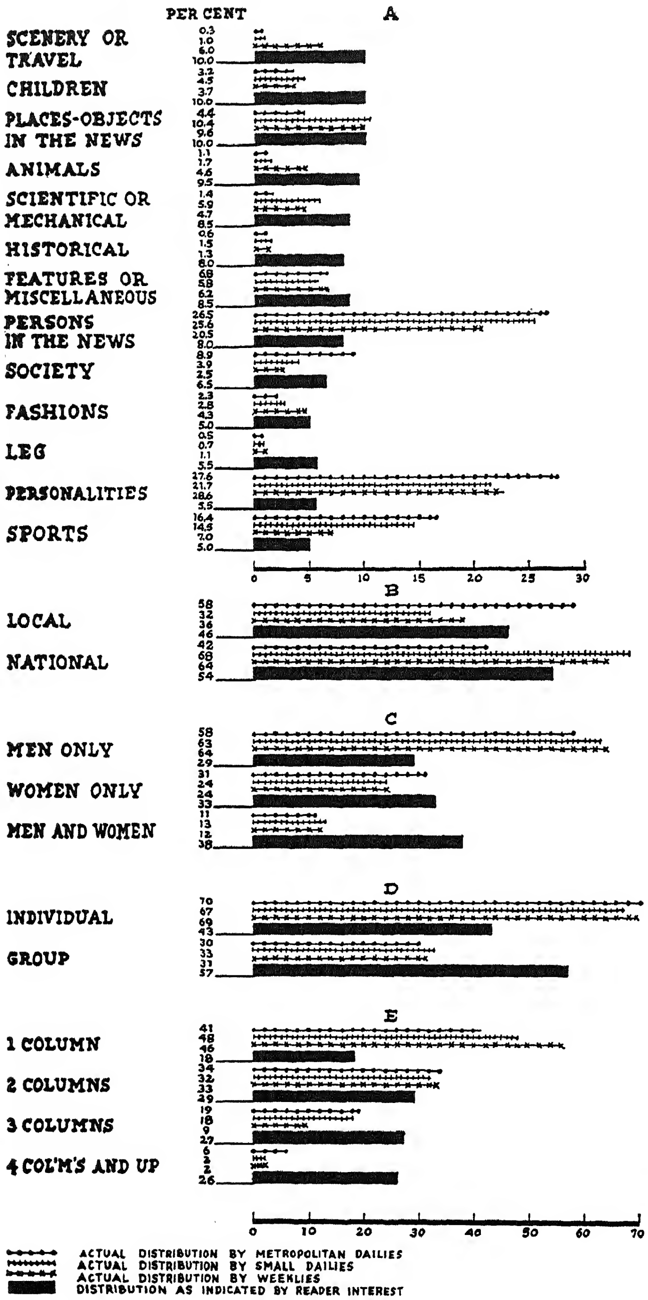
That there is an edge in favor of national is due, I believe, to the fact that the news photo services, with vast facilities at their command, and the whole world from which to draw, have been providing better photos than local sources.

If a picture is of persons, it shows women only, men only. or both men and women. The horizontal bars, Chart IC, indicate the relative degree of reader interest in pictures of these three classifications. Interest of men and women readers is greatest in pictures showing both men and women. Pictures of women only rank second, and pictures of men only, third.

You will note that women look at pictures of other women more than men do, and that men look at pictures of other men more than women do. Interest of women in pictures of other women is caused by the feminine desire to see how other women are dressed, and how they, personally, compare or can compare with these other women. That women readers look at pictures which show both men and women more than men do is caused by the stronger feminine desire to see, study and perhaps criticize the man another woman selects for a companion, husband, or associate, and vice-versa.

3. CHILDREN AND ANIMALS rate high in reader interest as shown in Chart No. I. This photograph by Dave Packwood shows Oscar and friend in active conversation. A perfect type of reader interest picture.

If a picture is of persons, it shows either one person or a group of persons. Chart ID. Interest is greatest in groups as against individuals. This checks with the previous classification breakdown which showed interest greater in pictures of both men and women as against each individually.



COMPARING ACTUAL DISTRIBUTION OF PICTURES BY NEWSPAPERS AGAINST DISTRIBUTION AS INDICATED BY READER INTEREST

CHART NO. II. This chart shows comparative treatment of pictures by classifications and type by three different newspaper groups, and compares this treatment with that indicated by reader interest.

Picture Size And Reader Interest

By now you have probably said to yourself, "Certainly group pictures will attract more readers. Chances are an individual photo is smaller, and the group photo, being larger, has a better chance of being seen."

So let's see how size affects picture interest. (Chart IE) Your first thought is perhaps that interest increases in direct proportion to the size of picture. This classification segment of bars immediately knocks this thought into a partially cocked hat. It *is* true as far as men readers are concerned, since the picture interest of men *does* increase proportionately, rising from 24% in the one-column cut to 35% in the two, 44% in the three, and 48% in the four and larger column sizes.

But the interest of women readers reaches a zenith at the two-column size, and drops thereafter. Percentages for women counterbalance those for men to such an extent that the composite figures indicate the two-column picture as that most likely to attract the greatest number of readers.

No provision is made for half-column cuts. Since 22% of all pictures published by metropolitan dailies and 11% of all pictures published by small dailies and weeklies are half-column in width, this omission is not to be completely disregarded.

Indications are, from recent studies, that the half-column cut is observed by about half of the readers who will see an illustration a full column in width. When placed adjacent to each other to give the impression of a one-column cut, half-column illustrations have a better chance of being seen.

The half-column illustration, as now most generally used, has severe limitations. In the overwhelming majority of cases, the half-column illustration is of persons, and shows only the head and shoulders of these persons. We do know, from our studies, that interest in the half-column cut, and in pictures of larger sizes as well, will increase about 35% when a person is shown in full length as against head and shoulders.

Having seen the figures on reader interest, in terms of percentages of total readers, and recalling previous statement that treatment of types of pictures has varied little since 1931, you are ready for statistical proof that the daily press is not using pictures in line with the dictates of reader interest.

Survey Facts At Work

By statistically weighting the reader interest figures, we are able to show how pictures should be distributed, by classification and type, and according to reader interest, as against distribution now given these classifications by both metropolitan and smaller city press. In other words, how many pictures out of a hundred published are in a given classification, and how many should there be as indicated by reader interest.

Here you begin to see this comparison (Chart IIA). The top horizontal line opposite each classification, with accompanying figure to the left, shows actual distribution by metropolitan dailies. The second horizontal line and percentage shows actual distribution by small dailies. The third, actual distribution by weeklies. The solid bar indicates the distribution as suggested by reader interest.

Of all pictures published by representative groups of both large and small dailies, 26% are of Persons in the News. In weeklies 20% are in this classification. Reader interest indicates that only eight pictures out of 100 should be of this type.

Reader interest has indicated more attention value for pictures of Places or Objects in the News than for Persons in the News. Following the indication of reader preference, ten pictures out of 100 should be of Places or Objects as against eight of Persons.

The smaller dailies and the weeklies are hitting reader interest on the nose, but metropolitan dailies publish only four per cent in this classification.

More Personality type pictures appeared in 1938 in metropolitan dailies than pictures of any other type. The percentage has grown each year, and now accounts for 28% of all pictures published in metropolitan papers and in weeklies, 22% of all in smaller dailies. Reader interest suggests only five per cent.

The publication of Feature, or Miscellaneous type pictures is about in line with reader interest, although smaller dailies are slightly deficient. Between six and seven per cent are being published; reader interest indicates around eight per cent.

5. DEATH ON FIFTH AVENUE. Here is a crash and disaster picture which carries quite high reader attention. It incorporates action, place and object in the news, and other factors. Photographer, Ray Howard, of the New York *Journal-American*, synchroflashed this picture with his 4 x 5 Speed Graphic at a distance of about 18 feet. Howard states, "It was one of those quiet mornings when nothing seemed to be going on. I left the office about 1:15 a.m. and soon I was cruising up Fifth Avenue with my camera ready for action in the car. I suddenly heard a crash and in less than 15 seconds I was at the scene. An auto had smashed into two plate glass windows, two women were sprawled at the curb, one killed instantly, and the other fatally injured. Seated in a daze in the wrecked car, on his face an expression of mingled horror and unbelief, was a young man later identified as Prince Alexis Dawydoff." This picture took top prizes in several photographic exhibits and contests.

6. LEGS. Surveys shown on Charts No. I and II reveal that women have a higher reader interest in pictures showing legs, fashions, and other women. Chart No. II shows that reader interest is greater than the actual number of pictures used.

Despite the fact that this is a scientific age, the like of which the world has never seen, the metropolitan daily press is devoting only slightly more than one per cent of all the pictures it publishes to pictures of a scientific or mechanical nature. Weeklies and smaller dailies do much better and almost meet reader preference, which, reflecting the tempo of the times, asks for better than eight per cent of its pictures in this classification.

Metropolitan dailies hit above reader preference for Society pictures, smaller dailies shoot below, and weeklies are most deficient except in the South. The large paper gives nine, the small paper four, the weekly two, when the reader interest indication is seven.

7. ANIMALS . . . carry a high reader interest which is far in excess of the number actually printed by newspapers. See Chart No. II. Jun Fujita photo of the first Panda in Chicago.

Sports vs. Animals

We have been called a sports-loving public, yet repeated reader surveys have disclosed that the sporting pages do not get the attention which warrants exceptionally heavy play on sports news and pictures. Sports pictures rank last in reader interest—an interest which calls for only five sports pictures out of 100 instead of the 16 now received in metropolitan papers, 14 in smaller dailies. Weeklies are more in line with seven against the indicated five.

Animal pictures, as you have already seen, rank high in reader interest—so high that publication of better than nine animal pictures out of 100 of all types would be in line with this interest. Actually, only one and two per cent of all pictures published in dailies are of animals. Weeklies do much better, presenting five per cent in this classification.

Three to five per cent of all pictures published are of, or include, children. Strong reader interest indicates ten per cent. Notice that the smaller dailies are closer to reader values than the metropolitan papers or the weeklies.

These studies do not concern themselves with ethical rules of practice governing newspaper publication. Because reader interest indicates that five per cent of all pictures should be leg photos, as against less than one per cent published, is no sign that newspapers should overlook ethics and adjust accordingly. The figures are presented for what they are worth.

Fashion and Travel Pictures

Interest in the dictates of Dame Fashion suggests that five pictures in a hundred published should be fashion photos, whereas today fashion prints are slightly better than two per cent of all published in dailies. Weeklies are more conscious of reader interest in fashions, and meet it.

You recall that interest in Scenery or Travel was greater than that in any other classification. Less than one per cent of all pictures published in dailies are in the Scenery or Travel classification. Reader interest indicates as high as ten per cent. Here again weeklies do a much better job—presenting six per cent of this type.

Last, but not least, the Historical print. Small dailies and weeklies are doing a slightly better job than metropolitan, but neither approach the eight per cent indicated.

Turning now to the local vs. national breakdown. (Chart IIB) Reader interest, you remember, was greater in national photos than in local. Today, in the metropolitan press, there is a six to four ratio in favor of local pictures; in the smaller dailies and weeklies a seven to three ratio in favor of national. Both are at opposite extremes from the reader's indicated preference. Small

dailies and weeklies need to build up local pictures, metropolitan dailies to cut down, each to reach the indicated ratio of 54-46 in favor of national.

All newspapers are dividing pictures of persons by sex in about the same fashion—heavy use of pictures of men, lesser use of pictures of women, and only small use of pictures showing both men and women. (Chart IIC) Reader interest suggests a reverse procedure—38% both men and women, 33% women, and only 29% men. Notice how close the parallel in distribution by small dailies and weeklies.

More group pictures are indicated by Chart IID. Instead of an approximate 70-30 ratio favoring individuals, a 57-43 ratio favoring groups is indicated.

Turning now to size (Chart IIE), we find that better than 40% of all pictures published, excluding the half-column cut, are one-column in width; around 30% two-columns; approximately 20% three-columns; and less than 10% four columns or more. Reader interest, as previously indicated, suggests heavier emphasis on the larger sizes. Notice how weeklies, generally hard-pressed for space, place emphasis on the one-column width.

Now what do these reader interest figures suggest to editors?

The facts suggest that editors publish more pictures in the classifications which are most likely to be seen, and fewer in those classifications which are least likely to be seen. They suggest that editors now have factual evidence which will enable them to first establish a definite pictorial policy, and then to make this policy in accord with the dictates of reader interest.

Editors do not lack source material. They have the news photo services to which they subscribe; they have their own staff cameramen; they can draw from the files; and they can draw heavily on their readers.

Editors have been shown how reader interest indicates distribution of pictures by types and classifications, and I hope that, among other things, it cautions them to go slow on their instructions to the art and engraving departments. They cut off 35% of the potential observers of a person's picture by sending it up for an outline head and shoulder cut. In many cases editors ask for outlines of an individual when the original print included other persons and particularly members of the opposite sex, thereby reducing potential reader interest. They trim down background, when that background includes familiar area or identifying area which will enhance reader attention.

With a single illustration, let me show how this knowledge of picture interest can be applied.

Two cars crash at an intersection. Four men are killed. Story and pictures make page 1. Common news treatment calls for pictures of the men killed. These pictures have a chance of being seen by 53% of the paper's readers.

Now, if a picture of the wrecked cars is shown, it will have a chance of being seen by 12% more readers than the pictures of the men killed. But . . . if the picture used shows a full view of the scene of the accident, including sufficient area to show identifying landmarks, the chances of the picture's being seen have increased almost 50% over the pictures of the men killed.

A picture has such value that it either supplements a news story, or completely eliminates the necessity for a news story. As a supplement it increases the value of the story, and actually increases the possibility of the story's being read. In cold fact, the story has a 50-50 chance of being read if the accompanying picture is seen. And any illustrated article in a daily paper has at least one chance in five of being read.

When a picture is of such value that it eliminates the necessity for more than an explanatory cut-line, it more than justifies its cost and the space it occupies. If a picture is seen at all, its cut-line will be read by three readers out of every four.

The larger the picture, the lower the percentage of readers who will read the accompanying story. This is indication that the larger picture, with its cut line, can almost stand alone.

8. SCENERY OR TRAVEL . . . is at the top in reader interest as shown on Chart No. I. There is an active interest in seeing good photographs from all parts of the world, including places in the United States. This photo by Frederick Simpson shows Balinese maids pounding rice on island of Bali. From R. I. Nesmith & Associates.

The half-column cut will do little for the story it illustrates. The story with a half-column cut will be read by 14% of all readers. A one-column cut jumps readership of the story up to an average 25%. As the picture gets into larger sizes, with its underline, it begins to tell a story by itself. Stories illustrated in three columns have an average readership of 19%. Average readership of stories illustrated in four columns is only 13%.

Through intelligent use of pictures, reader interest is intensified in the editorial content of a newspaper. And intensification of reader interest in the editorial content increases the effectiveness of the advertising columns.

The Advertising Photograph

Advertisers placing advertisements in the daily press do so because they know newspapers can deliver to them a certain guaranteed circulation.

Now, with modern advertising practice so highly and efficiently tuned to reader wave lengths through studies of reading habits, advertisers are expecting more than mere total circulation. They are beginning to expect newspapers to do their part in delivering this circulation to the exact pages on which their advertisements appear, and are making their own surveys to determine whether or not the newspapers are cooperating.

To intensify reader interest, and consequently to increase the effectiveness of the advertising columns, editors can, with a knowledge of the facts of reader interest, take their best reader pullers—principally comics and pictures—and distribute them throughout the paper to deliver readers in the greatest number to each and every page.

Once the editor delivers the reader to the page it is up to the advertiser to do his best in pulling the reader's eye to his advertisement. But the editor can help here, too.

Standard makeup calls for ads to be pyramided from the bottom, with editorial matter filling the hollow. Since the reader purchases his publication primarily as a medium for the dissemination of news, he runs through the paper in quest of editorial matter. By dropping some comics, some pictures, and others of the better editorial features below the fold, the editor can cause the reader's eye to come closer to, or pass across, the advertising on the page.

Perhaps you question the ability of pictures, which lack the day-to-day continuity of the comic strip, to pull readers no matter where they are located on the page.

In answer I give you figures on picture interest taken from a reader study in Louisville and Rochester made by the Gallup organization for the Bureau of Advertising of the ANPA.

Pictures below the fold on the two papers checked attracted more readers than pictures above the fold—and, by a pretty fair margin. Both men and women went down below the fold for these pictures. (Chart IIIA). As you notice, these two papers ran true to form in that women looked at more pictures than men.

Chart IIIB indicates the relative reader interest in pictures appearing in quarters of the papers—first quarter, second quarter, and so on. As you see, interest is greatest in pictures appearing in the first quarter, but not by such a margin as to indicate that pictures will not draw readers in great number to pages farther back. Interest drops from 59% to 51%, and in the third quarter to 45%. The picture page at the end of the fourth quarter pulls up the last quarter average to 54%.

The third quarter averages for men readers drop off because of society and fashion pages, while the interest of women holds up throughout.

Both papers studied were published in two sections. Chart IIIC. Interest of both men and women readers in first section pictures is greater than in second section photos, but the difference is only about ten per cent.

And last of all (Chart IIID), you see average interest in pictures on page 1 of the first section, page 1 of the second section, and as against the average for the rest of paper. This again suggests that while interest is greatest in page 1 pictures, interest in rest-of-paper pictures holds up well.

How the Photographer Can Profit From This Survey

Working press photographers who see this material immediately begin to wonder how they can make practical application of the results.

Most of them reason that many of the changes needed to establish a definite pictorial policy in line with the dictates of reader interest are not within their province. And it is true that, with so many pictures and picture sources available to editors, better selection and use by them is primarily indicated.

Photographers may supply pictures of persons in full length, only to have the editorial desk and the production department slash them down to head and shoulder outlines.

Photographers have no control over the size of their pictures as they appear in print, since in reproduction any picture can be blown up or pulled down at will. And photographers have no control over the local-national ratio their editors choose to establish.

But since photographers furnish the source material with which the editors work, any reform—if indeed reform is necessary—must begin with them.

Here are various ways, by no means all-inclusive, in which photographers can apply the information available:

1. When getting pictures of persons in the news, catch them in some form of action. Action photos will pull about 20% better than stills, and will get better interest from men than women. Take the shot full-length or at least better than head and shoulders. Try for some background which the reader can identify. Make a play for added interest by getting women as well as men. If there are any children or animals about, try to work them in.

2. These same suggestions apply to pictures of personalities. Break away from the monotony of so-called "characteristic" poses. Get them to do something . . . haul in a stray dog or cat . . . or find a couple of youngsters. If the personalities have anything to do with science or mechanics, try and get them with their related background, or with the objects with which they are identified. If the personalities are women, pay attention to their clothing to incorporate the fashion angle.

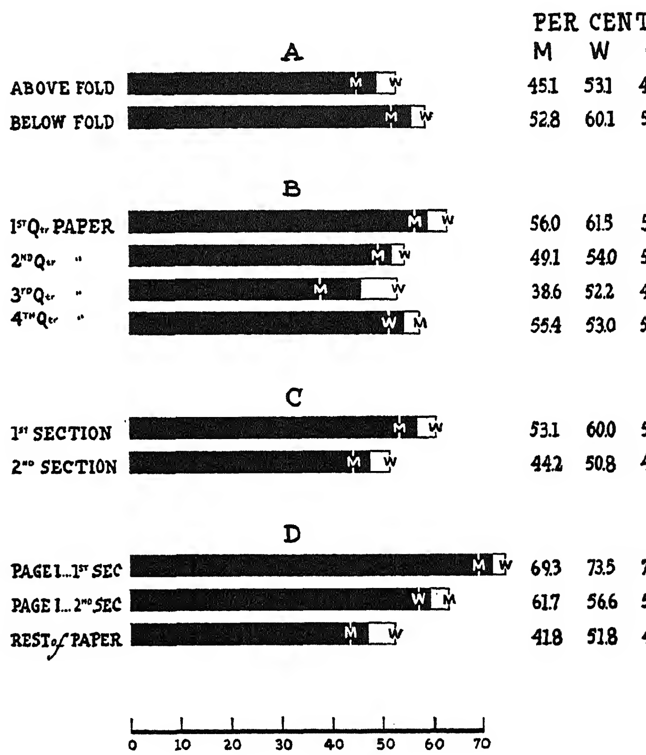
3. Readers are more interested in where, and to what, things happened than they are in the persons to whom things happened. Get pictures of the place and the object associated with the spot news event, even if unable to get the person in the news against the actual background or object itself. Think always of the possibilities of the photo-diagram, which never fails to attract high reader attention. Work in the value of scenery by catching not only a wrecked car, for example, but enough of the surrounding area to furnish the reader with identifying landmarks.

4. The photographer should be a good reporter, or at least a good fact-finder to provide the necessary who, what, when, where and why information for the cut-line. Cut-lines are not mere space fillers. More care should be devoted to the writing of underlines than to the writing of the story itself, since the picture will be seen by at least twice as many readers as will the story. The underline must tell the story and explain the relationship of the pictured person, scene, or object. That readers automatically drop down to the underline for explanation is evidenced by the fact that 75% of all underlines are read.

5. In the realm of sports reporting one can almost list the stock photos. There is the batter swinging, the runner sliding into second, the ball carrier being swarmed over by a mass of tacklers, the runner breasting the tape, the fighter punching the bag, and so on. Several newspapers have hiked interest in sports pictures by using panoramas of the scene of action, catching the play at the height of action, and then diagramming the progress of the play. The development of the long-range camera has made this type of presentation possible. Sport is action, yet photographers still insist on bringing back "posed" stills. A posed athlete takes up just so much space without pulling readers to justify that space.

6. There are children and animals everywhere. Children are at the scene of most every spot news event, and most always are in the family of persons to whom things happen. Keep your eye out for them, and your cameras trained to bring them in. Tragedy leaves pets unfed and uncared for, and the touch of the weeping and neglected child with a pet is a touch which never fails to pull.

In short, my suggestion to photographers is that they study the elements with known reader interest, and wherever and whenever physically able to do so, incorporate as many of the elements as possible in the pictures they take. If photographers do their part, editors can have no excuse for not doing theirs.



READER INTEREST IN NEWSPICTURES BY LOCATION IN PAPER

CHART NO. III. Pictures will attract readers no matter where located in the paper, as this chart indicates. While percentages drop off on pictures deeper in the paper, the decline is slight.

1. DENTAL DISPLAY BY SYNCHROFLASH. This photograph is a typical example of what can be done with one medium size flashbulb. The whole spontaneity and action of these youngsters is captured in a fraction of a second at the Treetops Children's Camp near Lake Placid, N. Y. 1/100 second, f/16, Fast Pan film, 3¼ x 4¼ Speed Graphic camera. Photo by Willard D. Morgan.

SYNCHROFLASH PHOTOGRAPHY

WILLARD D. MORGAN

Synchronized flash photography with today's flashbulbs has been one of the most important developments in modern photography. The most important stimulus to this development has been the combination of Speed Graphic cameras and flashbulbs in news photography during the last nine years. In fact, it was the newsman who really pioneered this field. Today, however, the advantages of the modern synchronizer are available to everyone.

The term Synchroflash simply means that a flashbulb can be ignited at the same moment that the camera shutter is opened by means of an intermediate synchronizing mechanism. This synchronizer takes form as a mechanically or electrically released tripper which fits directly on to the camera shutter. Ordinarily, a 3 to 4½-volt dry cell battery is used to ignite the bulb and also operate the electrical tripper.

It takes approximately .020 to .022 part of a second before the average short-duration flashbulb reaches its peak of burning intensity, and about .015 part of a second in the case of long duration bulbs before a useful intensity of flash is reached. The synchronizer is thus essential for proper timing of the camera shutter so that it opens at the most advantageous period of the flash. It is easily seen that if the shutter opens too early, only a small portion of the flash will be used; therefore, with accurate adjustment, the full output of the flashbulb is utilized for slow shutter speeds as well as for the faster speeds.

As the flashbulb is so intense in brilliance, it is possible to use small diaphragm stops and also fast shutter speeds at close distances. This means that even with the 4 x 5 Speed Graphic cameras it is possible to produce sharp detailed negatives with a fine depth of field. In fact, a flashbulb gives the larger camera all the advantages which can be obtained with small cameras using short focal length lenses when it comes to depth of field. Still another advantage of the flashbulb is that the photographer can make a picture anywhere without depending upon light of any kind. With a synchronizer fastened to his camera he is always sure of light in the field of view of his lens, no matter where he points his camera. This fact alone is the greatest asset for the modern photographer who has equipped his camera with a flashbulb synchronizer.

Synchroflash photographs appear in every daily newspaper and all of the national publications. In fact, it has been the development of this phase in photography which has made it practical to produce the modern picture paper. Today we see the intimate actions of political leaders, as well as the hairpin turns of indoor skaters stopped at 1/1000 second when using the synchronizer with the Speed Graphic focal plane shutter.

The Single Flash

The great majority of flash pictures are taken with one bulb synchronized to either the front compur type shutter or to the rear focal plane shutter of the camera. This makes it possible to have a camera and a powerful light source in one compact unit free of any connecting wires. Such a unit is extremely flexible and undoubtedly the ideal setup for the news photographers as well as

2. THE STORY HOUR, at Camp Treetops, Lake Placid, N. Y. Children and their groups make perfect subjects for synchroflash photography. 1/100 second, f/16, medium size flashbulb, Fast Pan film, 3¼ x 4¼ Speed Graphic. Photo by Willard D. Morgan.

3. This photograph made by John F. O'Reilly is the result of setup shown in the photograph at the bottom of this column. A synchronized flash picture using two flashbulbs. 1/100 second, f/16, Fast Pan film.

other photographers who are interested in quick high speed action.

There is a tendency in single flash photography to overexpose the highlights in a picture. Care should be taken to avoid overexposure and hard contrasty negatives. Many times the single flash picture can be improved by using supplementary reflectors or by placing the subject near a light wall to utilize the reflection into the darker shadows. This is where the use of two or more flashbulbs are of advantage. This is known as the multiflash technique.

Multiflash Technique

When using two or three flashbulbs in synchronization with the camera, complete freedom of lighting is obtained. For example, in portraiture any type of illumination can be obtained similar to ordinary flood or incandescent bulb lighting. A flashbulb can be placed close to the subject or a little farther away in order to increase or decrease the amount of illumination. To avoid the typical bleached white-faced exposures a medium flashbulb can be used for front illumination while a stronger one can be used to give full side lighting. In fact, all the principles which have been presented in the chapter on illumination can be carried out with the use of the multiflash technique. This fact is sometimes overlooked by photographers. The chapter on illumination gives actual lighting setups which can be used for multiflash photography.

Of course, the one point to remember is that the illumination cannot be checked on the subject with a flashbulb. At first it is advisable to use floods in reflectors for arranging the proper lighting. When the photograph is to be taken these pilot lights can be removed from their position and the flashbulbs substituted in exactly the same position before making the exposure.

Another advantage in using the synchronizer is that the remote control connection can be used. This hookup consists of an extension wire with a hand switch on one end and of connection terminals to the synchronizer on the camera. The camera is set up on a tripod and the proper adjustments made. Then the operator takes the

4. A MULTIFLASH LAYOUT. A behind-the-scenes photograph made by Willard D. Morgan to show complete layout of a photographic scene directed by John F. O'Reilly who holds the camera. 1/100 second, f/16, two flashbulbs, Fast Pan film.

5. Another back-stage scene showing John O'Reilly in action with his multiflash equipment. The assignment was to photograph a couple coming up the stairs to the Lounge Deck of the "S.S. Empress of Britain." 1/100 second, f/16, Fast Pan film. Synchroflash photo by Willard D. Morgan.

extension cord or remote control and takes up an advantageous position away from the camera. This feature is an advantage in nature photography where a bird's nest or some animal is to be photographed at close quarters. Again, it can be used in photographing people or for setting up the camera in special positions where the presence of the photographer might detract from the picture. It also allows the photographer to get into the picture if he wants to.

Synchro-Sunlight Photography

Anyone who has observed the news photographer in action during the day will note that the flash synchronizer is rarely moved from his camera. This photographer may be seen using a flashbulb in broad sunlight. Naturally the first thought is that such a technique is wasteful of flashbulbs. However, this is far from the case. The flashbulb is used to illuminate distracting dark shadows while the general sunlight gives the complete illumination of all the background. Such a combination greatly improves the quality of the news photographer's negative. At the same time it may give the photographer a chance to use a smaller diaphragm stop or possibly a faster shutter speed.

This combination of daylight synchronized flash, can be utilized in many other photographic fields besides that of the news photographer. For example, the fashion photographer who wishes to use outside natural surroundings will find the use of flashbulbs very valuable. Dark shadows under large hat brims can be illuminated to avoid producing a face which is half black and half white. Here again unusual photographic lighting can be obtained under trees, balconies, or other places where the illumination is considerably less as compared to the natural outdoor sunlight.

When photographing indoors it is possible to use a flashbulb to illuminate the interior and at the same time balance this illumination with that of the outside sunlight. Exposures of such pictures show all the interesting details of an outdoor scene through the window. At the same time the interior is equally illuminated.

Flash photography also allows the press photographer, who sends in his negatives by messenger, to know that the darkroom man will give the proper processing time. As most of the fast films are used and must be developed in total darkness it is important to have uniform exposures for the best results. The exposure average in newspaper flash photography is quite constant, for this reason the final processing can easily be carried out in complete darkness without the necessity of inspection.

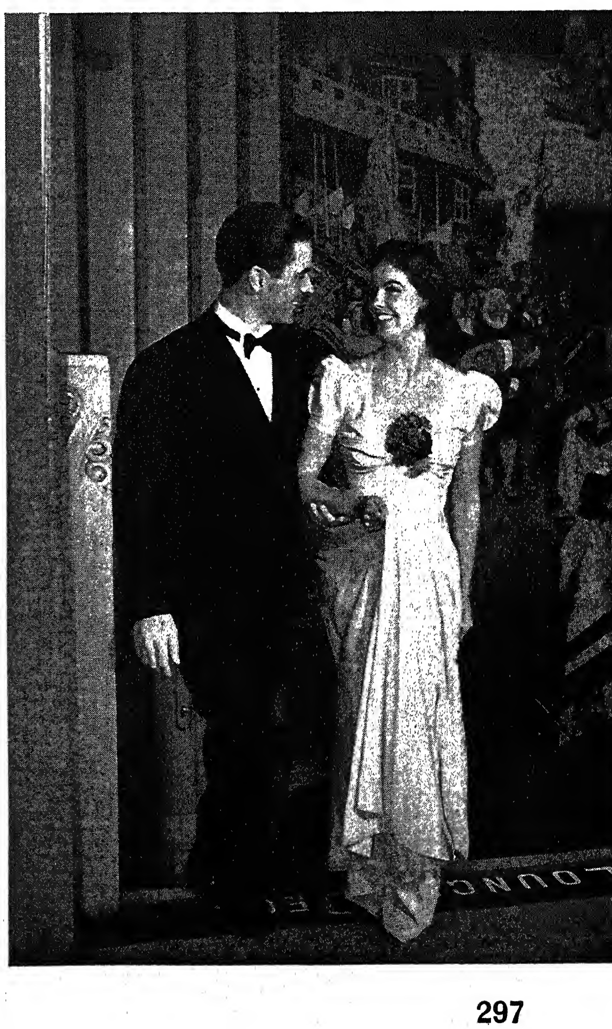
Multiflash From 110-Volt Circuits

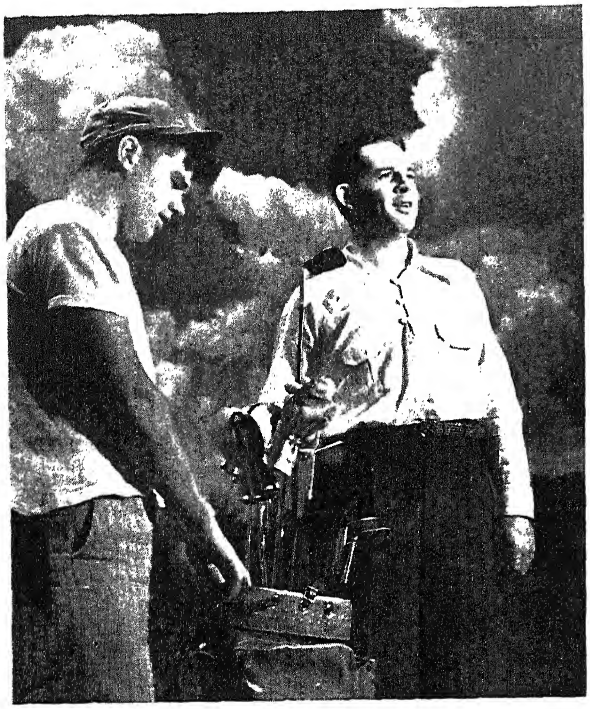
We have seen that for ordinary multiflash photography using two or three bulbs at a time it is possible to synchronize with the ordinary 4½-volt battery. If the Kalart 9-volt battery case is used, 4 bulbs can be used for synchronization with fast shutter speeds of 1/100 or 1/200 second. The 18 gauge wire is recommended. It is possible to synchronize up to 6 flashbulbs at the faster speeds provided No. 14 gauge wire is used. If you are making photographs with the open and shut technique, the 9-volt battery case will fire as many as 10 bulbs.

The reason that 10 bulbs are not recommended for high speed synchronization, when using the 9-volt battery, is that the bulbs may fire at slightly different intervals. This would mean that the full efficiency of all the bulbs could not be utilized at speeds of 1/100 second or more. This is why the open and close technique is recommended. To do this simply set the shutter at "bulb" and open the shutter for possibly a quarter or a half a second before it is allowed to close again. The flash takes place during this interval.

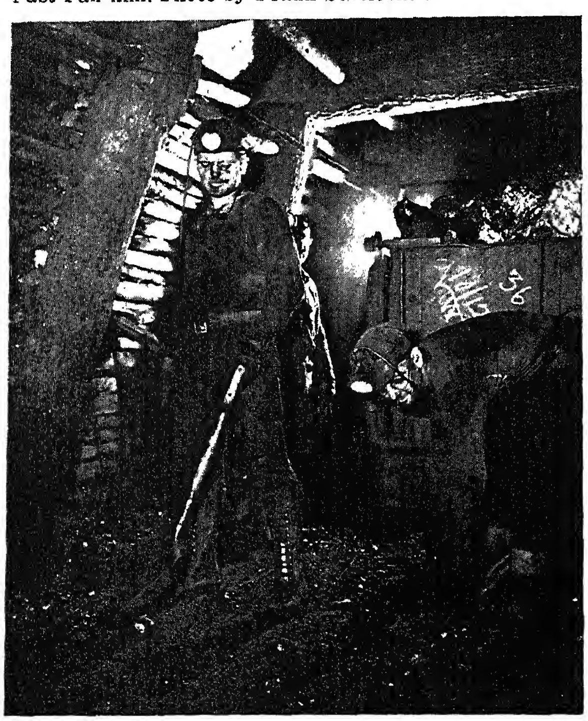
When a large number of flashbulbs are to be hooked up for synchronization with the camera shutter they should be connected in straight series. With such a wiring method a maximum of 30 flashbulbs can be fired at one time from the ordinary 110-volt house current. This

6. THE COMPLETED ASSIGNMENT. This two-bulb synchroflash picture was photographed as shown in Figure 5. The extension light held fairly high to throw illumination on the background to give better depth. Photo by John F. O'Reilly.

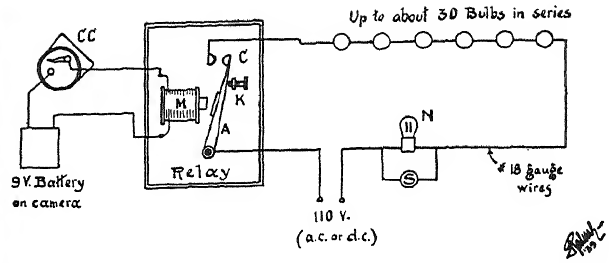




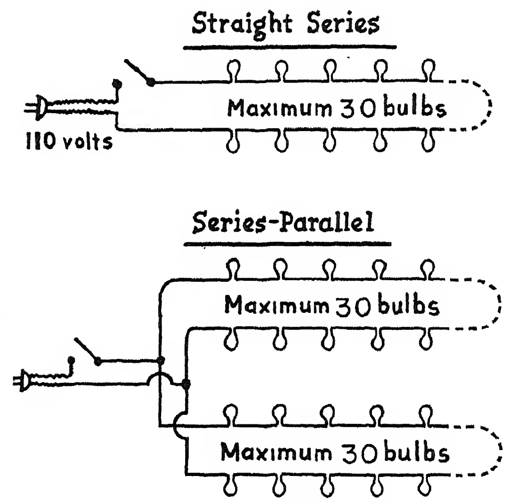
7. **SYNCHRO-SUNLIGHT FLASH.** Note that sunlight comes from the left with the flashbulb illumination on extension at right. Flashbulbs serve to brighten up the lighting in daylight photography. 1/200 second, f/11, A filter, Fast Pan film. Photo by Frank Scherschel.



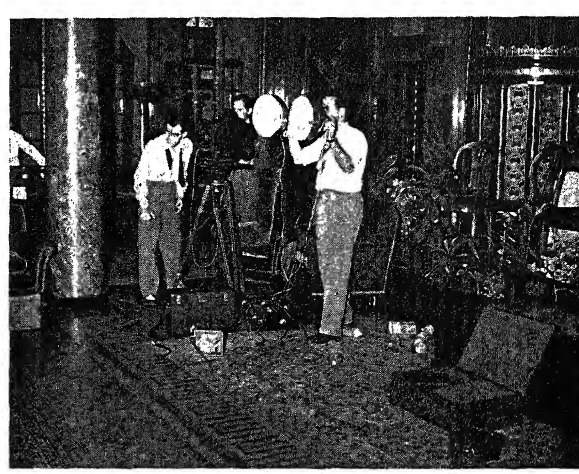
8. **LOADING COAL.** A two-bulb synchroflash picture. Note extension wire in middle foreground. Extension flash gives greater depth to an otherwise black background when one bulb is used. 1/200 second, f/8, Fast Pan film. Photo by Jack Delano, Pennsylvania Art Project, W.P.A.



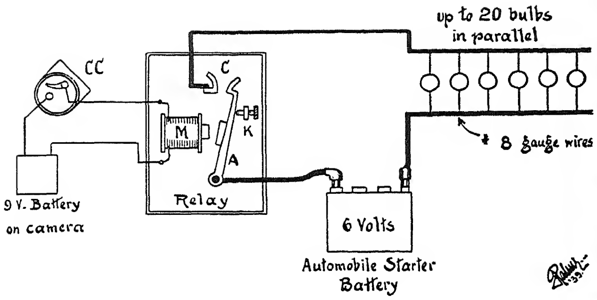
9. Wiring diagram for multiflash photography showing complete circuit with intermediate relay for 110-volts. N is neon bulb which glows when entire circuit is complete, and S is a shunt in circuit. All circuit drawings on this page made by Arthur Palme.



10. Straight series and series parallel wirings for open flash photography when using 110-volt house current. Remember that only certain bulbs are recommended for 110-volt use.



11. **AN OPEN MULTIFLASH SETUP.** Note that John O'Reilly holds the shutter bulb in one hand and the switch to the multiflash outfit in the other. A 50-volt battery used when regular 110-volt current failed. Kalart multiflash box with extension wires may be seen at the base of the tripod. Eight extensions to flashbulbs in reflectors.



12. Wiring diagram for use with the 6-volt automobile battery. In this case 8-gauge wire is indicated. With only a few bulbs a slightly larger gauge wire may be used.

is assuming that No. 18 gauge wire is used throughout. For synchronization with the shutter it is necessary to have a special relay wired into this series circuit to fire any number of bulbs up to the maximum of 30. The relay is closed from the current supplied by the standard battery on the camera synchronizer. The instant the relay is closed the current is cut off from the synchronizer. However, at the same instant the synchronizer has tripped the shutter. With this type of relay hookup it is impossible for the 110-volt circuit to enter the synchronizer mechanism and probably burn out the contacts. On the other hand, if the open and close type of exposure is to be made a relay is not required. In this latter case, there is no connection with the camera shutter. The flashbulbs are set off by an ordinary hand switch held in one hand while the shutter is opened and closed with the other hand. *Note:* Some flashbulbs are not recommended for use on the 110-volt house current. Check with the manufacturer to determine which bulbs are recommended. In the case of Wabash bulbs the Press-40 and 50, Nos. 0, 2, 2A, 3 and No. 3X are recommended and the G. E. bulbs Nos. 11A, 21, 50.

Parallel Wiring

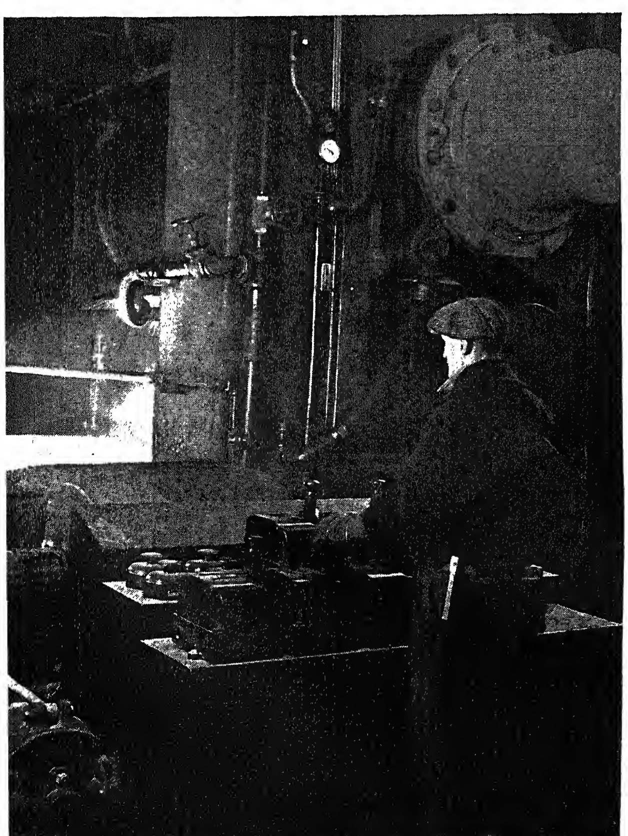
When the flash lamps are wired in parallel the current flowing through the circuit is the same as that which would flow if only one lamp were flashed at a voltage equal to the line voltage divided by the number of lamps in the circuit. In other words, if we have ten flash lamps wired in parallel and each lamp required approximately 1½ amperes for flashing, this would take a maximum of 15-amperes for the complete bank of ten flashbulbs. Stating this problem in another way, we can say that the current required for one lamp (1½ amperes) flashed from 110-volts should be multiplied by the number of lamps in order to get the total current which flows for that instant.

There are wiring possibilities which permit the firing of at least 200 flashbulbs at one time if necessary. However, in this case it is advisable to get in touch with the synchronizer manufacturers for complete information. On the other hand, if there should be an occasion where you may require as many

13. (*top*) **BOYS TOWN.** A synchro-sunlight flash picture made during the filming of the motion picture. Note better detail in shadows which otherwise would have been very dark because of strong sunlight. 1/200 second, f/16, (*middle*) The ordinary photograph showing hard dark shadows under hat brims. 1/200 second, f/11. (*bottom*) Photo taken under same conditions as middle picture; however, one flashbulb makes this tremendous difference in facial illumination. All three photographs made by Ernest Bihler.

14. IN A PINCH. This flash picture was made at night. Carefully posed with policemen talking to each other as instructed. The flashbulb on extension was set off just above the radiator cap of the car when facial expressions were right. Camera placed on tripod pointing into open door on other side of car. An open flash exposure at f/11, Fast Pan film. Photo by Arthur Palme.

15. AN INDUSTRIAL SCENE BY FLASH, Republic Steel Company, Cleveland. f/16, open flash using three No. 21 Flashbulbs, Fast Pan film. Photo by Tom Foley.



as 60 flashbulbs to be fired in synchronization at one time, you can use the series-parallel hookup. The accompanying diagram gives details about this method.

There are also times when an ordinary 6-volt automobile battery can be brought into service. Here, again, the accompanying diagram will give complete information about the number of bulbs which can be used. Up to 20 flashbulbs can be safely fired with this parallel car battery hookup. In this case a relay would not be required in the hookup. To use a current of 45-volts or more there is danger of burning out the contact points in the synchronizer. Also the operator might receive an unpleasant shock from the current.

The regular 110-volt current is regularly used by banquet photographers who use the Victor Contact switch for open and shut exposures. When the flashbulbs are wired in series each bulb acts like a fuse and when one is not connected properly or is defective it prevents all of them from firing.

Synchronizers For Front Shutters

Most of the synchronizers now available for the Speed Graphic cameras are the electrical magnetic tripper type. This includes the Graflex and Mendelsohn synchronizers. The Kalart Automatic Speed Flash is the principal exception. The Kalart is known as the automatic mechanical type synchronizer, the difference being that the all-electrical synchronizers have a magnetic tripper attached to the lens board and tripper of the shutter. The Kalart automatic mechanical type has just an extension metal wire release joining the automatic synchronizing unit on the battery case directly with the release mechanism of the front shutter. The Graflex synchronizer for Speed Graphic cameras is the latest development in the all-electrical type of synchronizer.

The Graflex Synchronizer

With important new developments the Graflex and Speed Graphic cameras are even more adaptable for flash synchronization than ever before. So far the Super D is the only Graflex model equipped with a flash synchronizer. This operates as a built-in unit for automatic exposures at the shutter setting of 1/5 second. A completely new front shutter synchronizer has been developed for Speed Graphic cameras.

As the heart of any synchronizer is in the operation of the shutter tripper, it is important for us to analyze this new Graflex flash synchronizer which is being made for between-the-lens type shutters. The solenoid release is of an inertia-type, high resistance solenoid. In other words, it consumes a very small amount of current and therefore favors a higher reserve amperage which is a definite safety factor for the flash of the lamp. Because the solenoid release uses such a small amount of direct battery current, there can be a greater allowance for battery strength fluctuations.

Once the Graflex synchronizer is properly adjusted, readjustment is not required as the battery output is reduced by low temperatures, momentary exhaustion or age. In fact any standard type of dry cell can be used. It is not necessary to have special flash batteries.

In operation the Graflex flash synchronizer has a momentary free starting movement. In other words, the tripper does not start out with the dead weight of the shutter release, but it has an opportunity to accelerate to the point where the shutter release is picked up before the shutter is released. This action is constant and insures even and regular synchronization.

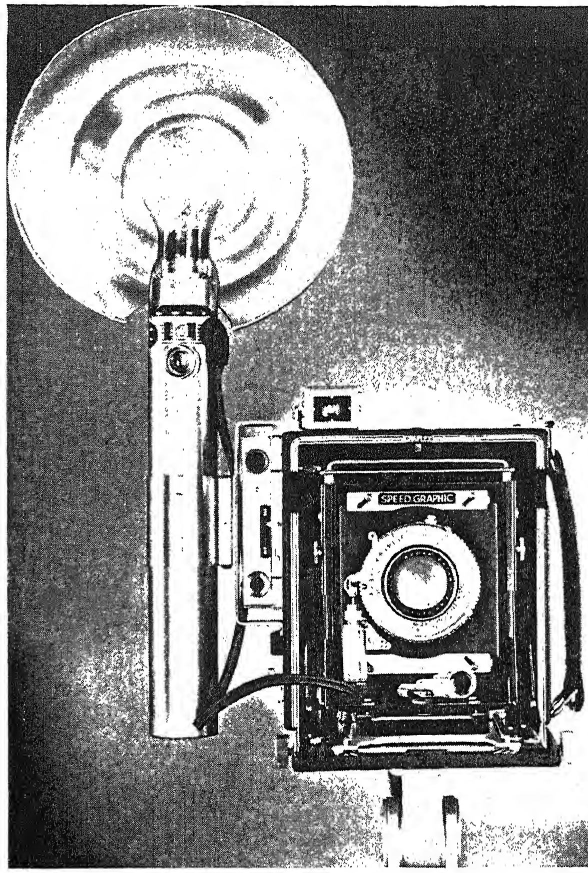
1. Other important features of the new Graflex flash synchronizer include a permanent mounting of the solenoid tripper on the lens mount for the 3¼ x 4¼ and 4 x 5 Anniversary Speed Graphics. When closing the camera only the connecting cord is detached. Special detachable mounts are available for other Speed Graphic cameras.

2. Two-cell and three-cell models of the Graflex synchronizer are available with solenoid releases for each type. These are not interchangeable. Naturally the three-cell battery case is recommended for flashing up to three or four bulbs in multiflash work.

3. The same battery case can be used for front shutter synchronization or for use with the focal plane synchronization when the Speed Graphic is properly equipped. The main switch of the synchronizer is adjusted with the series outlet in such a way that it is automatically put out of action when the focal plane shutter or remote control leading wire is inserted. This eliminates accidental firing of the flash lamp.

4. A special focusing spotlight is built right into the battery case. This is convenient for use with the range finder or for groundglass focusing under poor lighting conditions. Also, it is valuable for centering principal subjects in the view finder under difficult light conditions. Still another advantage is that the brilliance of this spotlight will tell you whether your dry cells are strong or weak.

As a special check-up to show the low current consumption of the solenoid tripper, hold the main switch on the battery case for a moment while the spotlight is turned on. You will note that the light is dimmed only slightly with the Graflex release.

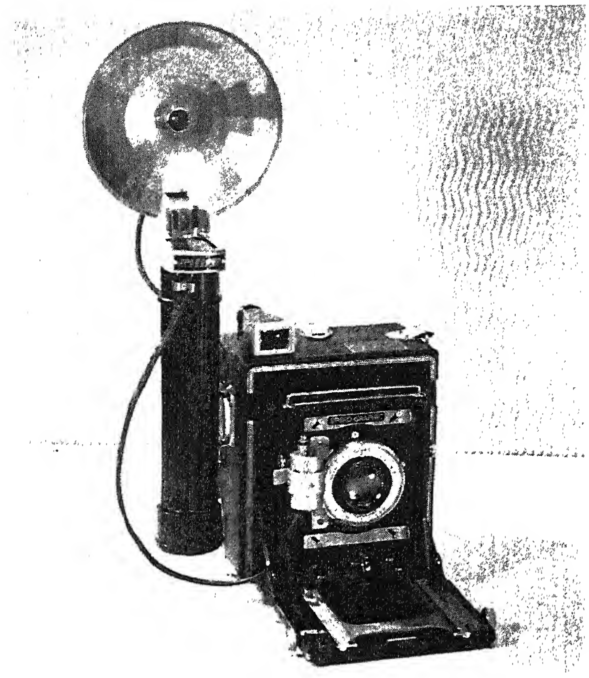


16. GRAFLEX FLASH SYNCHRONIZER, attached to the Anniversary Speed Graphic. The shutter tripper is permanently mounted on the front lens board of the camera. Small detachable hook fits into the Supermatic shutter release as shown in the above illustration. This feature makes it possible for quick uncoupling of the synchronizer tripper when the camera is to be used for ordinary photography.

Graflex Synchronized Open Flash

On the Super D Graflex there is provision for Open flash synchronization. This built-in synchronizing contact is only recommended for the 1/5 of a second shutter speed. To operate the flash, the camera is adjusted to the drop curtain setting (Slit 0 and Tension 1). Short burning flash lamps such as the Mazda "SM," give exposures up to as fast as 1/200 of a second. The longer burning flash lamps can also be used. In this case exposures will vary down to possibly 1/25 of a second. It is the short or long flash duration of the lamp which determines the exposure. The actual shutter is open over the entire film area for at least 1/5 of a second. This arrangement not only insures complete synchronization but it also uses every lumen of the flashbulb.

With the continued use of the Kodatron high speed lamp, photographers will find that the Super D Graflex is well adapted for this type of photography. The Kodatron lamp may be attached directly to the flash synchronizing unit. The high speed of 1/10,000 of a second flash of the Kodatron light determines the exposure. The accompanying illustration shows the Super D Graflex with the Open flash synchronizer and the automatic diaphragm in position.



17. MENDELSOHN SPEED GUN. This illustration shows the Mendelsohn Plastic Model "DPDS" equipped with a 5-inch Twinflector mounted on a Speed Graphic with Supermatic shutter.

The Mendelsohn Speed Gun

The Mendelsohn Speed Gun has been used for many years by press photographers. This is an electro-magnetic synchronizer. As seen in the accompanying illustration, the electrical tripper is mounted on the front lens board of the Speed Graphic camera. The new Mendelsohn DP Speedgun is now available for use with the 3¼ x 4¼ and 4 x 5 Speed Graphic cameras.

Attachments are available for Compur shutters and Supermatic shutters. A special Junior DP special gun is made for the 2¼ x 3¼ miniature speed graphic.

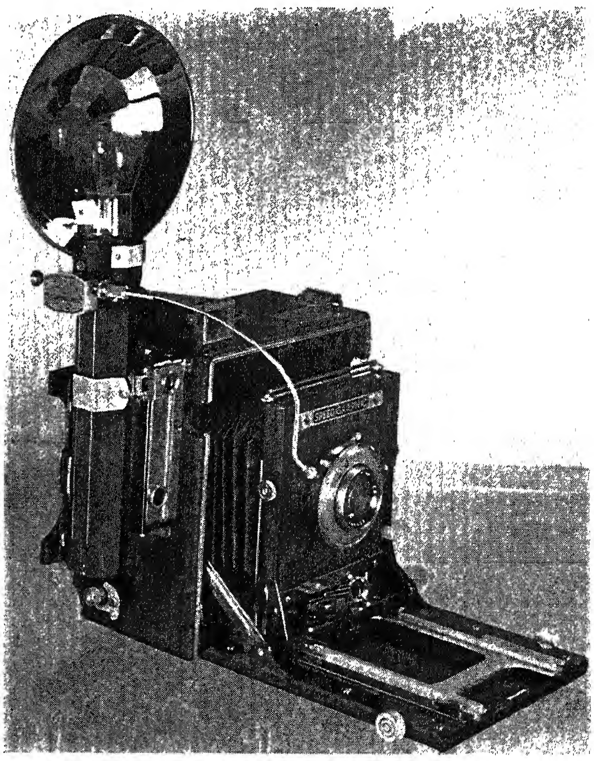
The Mendelsohn Speed Guns are now furnished with plastic battery cases. Another feature includes adjustable aplanatic twinfactor for use with either standard or midget base flashbulbs. Mendelsohn supplies a multiple flash assembly for making synchronized flash pictures of groups, conventions, sporting events, and other subjects which require a number of synchronized flashbulbs. With this flash assembly, as many as eight bulbs may be flashed in synchronization at one time with the camera shutter. This unit can be used with the standard house current or with the special hot shot battery.

Kalart Automatic Synchronizer

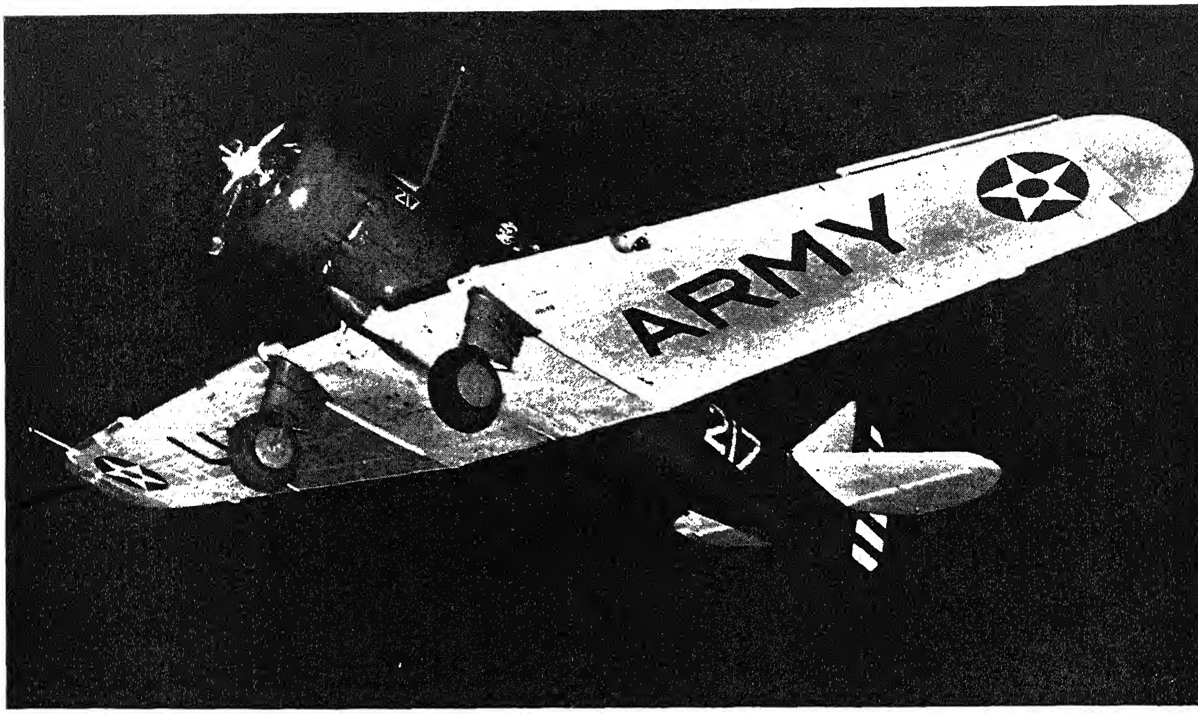
The Kalart Synchronizers now available do not have the typical electrical tripper for releasing the shutter. The new Kalart Automatic Synchronizer has a metal plunger which screws directly into the wire release socket of the shutter. The synchronizer and tripping unit is built onto the battery case. The automatic feature comes in the quick resetting of the release after each use. Formerly the Kalart Speed Flash had to be reset by hand before resetting the shutter and tripping for the next picture. The new automatic speed flash has eliminated this intermediate setting.

A plastic battery case is available which clips onto the encircling bracket over the Kalart lens-coupled range finders on the Speed Graphic cameras. Provision is made for a plug-in for extension flashes. There is also a push button for Open and Shut flashes and a quick changing socket. Another outlet is provided to permit the use of this battery case with micromatic synchronizing trippers. The battery case and also the reflector may be adjusted to various heights alongside of the camera bracket. This permits the base of the battery case to line up with the base of the camera, a convenience when setting the camera on a table.

The Kalart Company also supplies a 9-volt battery case in addition to the standard 4½-volt battery case. This larger battery unit is recommended with multi-flash synchronization where 2 to 4 bulbs are used at one time.



18. KALART AUTOMATIC SPEED FLASH SYNCHRONIZER. This automatic mechanical improved synchronizer is self-setting after each exposure.



19. AERIAL FLASH. This synchroflash picture is believed to be the first one made of an airplane in full flight at night without aid of ground illumination. Only one large flashbulb was used with a 4 x 5 press type news camera. 1/100 second, f/6.3, Fast Pan film. Photo by Private, 1st Class, Leslie W. Bland, Randolph Field, Photo Department. Made at 3,000 feet altitude about 10 o'clock at night.

The Kalart Automatic Speed Flash will also operate with the National Graflex camera. In this case the Speed Flash determines the length of exposure by the duration of the flash. Therefore the shutter of the National Graflex must be set at 1 (1/30) and wound only half way. The battery case may be attached to the tripod socket at the bottom of the National Graflex.

The Focal Plane Shutter Synchronizers

With the introduction of the Wabash 2A Superflash bulbs and the General Electric No. 6 and No. 31 Photoflash bulbs with longer burning characteristics, it is possible to synchronize for focal plane exposures. If the traveling time of the focal plane shutter is greater than the operating time of the front compur shutter, bulbs with longer burning peaks are essential. The No. 2A and No. 31 bulbs were introduced in the early part of 1939. At that time the various synchronizer manufacturers produced new back-shutter synchronizers. These included the built-in synchronizers by Folmer Graflex and the Kalart Sistogun.

The Speed Graphic Synchronizer

The built-in Speed Graphic synchronizer is now standard equipment on all of the 2¼ x 3¼ cameras. There are two contact fingers within the focal plane mechanism of the camera. These fingers are brought in contact at a predetermined time equal to the ignition lag of the bulb before the shutter slit begins to pass across the film area. A battery case and reflector are attached to the built-in synchronizer by means of a connecting cord. All shutter speeds from 1/60 to 1/1000 second can be used for synchronization provided the recommended flashbulbs are used. Also the new SM Graflex synchronizer.

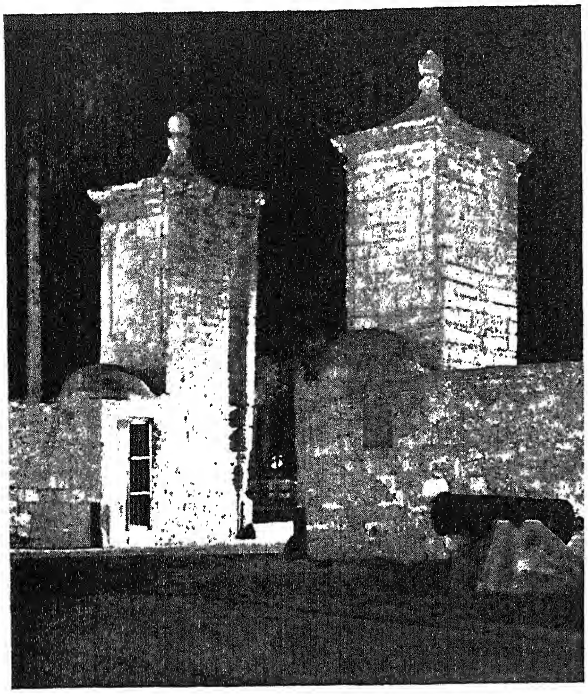
At the present time the No. 2 or No. 2A Superflash lamps and the No. 6, and the No. 31 Photoflash lamps can be used for focal plane synchronization with the 2¼ x 3¼ Speed Graphic camera. The 2A and No. 31 bulbs are recommended for focal plane shutter use with the 3¼ x 4¼ and 4 x 5 Speed Graphic cameras.

When using the built-in synchronizer on the Speed Graphic camera care should be taken to prevent accidental firing of the flashbulb when setting the shutter. The bulb should not be inserted into the battery case socket until after the focal plane shutter has been set.

The Focal Plane Graflex type of built-in synchronizer is available on special order for the 3¼ x 4¼ and 4 x 5 Speed Graphic Cameras. These larger Speed Graphic Cameras must be sent to the Folmer Graflex Corp. in Rochester for installation.

Other Focal Plane Synchronizers

At the present writing there are several focal plane synchronizers which attach directly under the winding key of the Speed Graphic cameras. These "winding key" types of synchronizers include the Sistogun, which



20. THE OLD CITY GATES, ST. AUGUSTINE, FLORIDA. A night shot made by Jack B. Penfold using the open flash method. In this case the camera shutter was left open while Penfold flashed four different bulbs from four different positions to make this excellent exposure.

is made by the Kalart Company and the Smeaton Focal Plane Synchronizer. These focal plane synchronizers can be installed on the 3¼ x 4¼ and 4 x 5 Speed Graphic Cameras. When using the outside winding key type of focal plane synchronizer it is necessary to "pack" the focal plane shutter before starting to use the camera.

The focal plane shutter on the Speed Graphic cameras has a slight variation when used with the Kalart Sistogun and Smeaton focal plane synchronizers. In order to keep the focal plane shutter operating at a more constant point a preliminary warmup or shutter packing must be carried out. To do this, wind the focal plane shutter to the shutter opening to be used. Then release the shutter as if making the picture, and then rewind. Repeat this winding and releasing operation three times and then set the shutter for making exposures. From then on it is not necessary to repeat the shutter tightening process until such time as the shutter has been allowed to "run down," in which case it should be "repacked" before being used for synchronization.

Many excellent focal plane synchronized flash pictures have been made by using the top speed of 1/1000 second. For the first time it has been possible to photograph the fast floor plays during a basketball game by using the focal plane synchronizer set at 1/1000 second. Dancers, skating exhibitions, indoor athletic contests and many other fast-action photographs are now possible with the focal plane synchronizer flash. Focal plane flash pictures were made by the *Detroit News* photographers in 1937 and 1938 using the No. 2 Wabash flashbulb, and were the early pioneers in this type of back shutter synchronization.

Flashbulbs And Their Characteristics

At the present time there are approximately 23 different types and sizes of flashbulbs available. As far as the average photographer is concerned, he will probably select two or three different bulbs for most of his work. In fact, some photographers have carried out their photographic work with just one type of flashbulb. In order to obtain a clearer idea about these flashbulbs, let us classify them as follows:

1. The phenomenal development of the peanut size flashbulb is notable. These midget bulbs are finding new users every day. The General Electric Company developed the first small bulb known as the Midget Synchro-Press No. 5. When using the proper reflectors with this little bulb, over two-thirds of all average flash pictures can easily be made when using front between-the-lens shutters. A companion to No. 5 is the Mazda Synchro-Press No. 6 which has a longer flash peak and is ideally suited for use with focal plane shutters. One of the latest additions to the mazda line is the SM Midget flashbulb. This gas-filled bulb has a quick flash peak of 1/200 of a second. This bulb is ideally suited for use with the new Super D Graflex Flash Unit.

   In the Wabash line there is the Superflash Press 25, which is only slightly larger than the Mazda midget bulbs. The chances are that the midget bulbs will become even more popular than at present with continued development in the equipment for their use.
2. The next group includes the small standard base flashbulbs such as the Mazda No. 11 and the Superflash No. 0 wire-filled bulbs. These bulbs are recommended for front shutter synchronization only. They do not have the intense light output which can be obtained with the larger bulbs; however, these bulbs can be used for all types of close-up exposures, which includes portraits.
3. Good medium sized flashbulbs for average use include the Mazda No. 16A and the Superflash Press 40 and Press 50.
4. When more light output is required for covering small groups, extension flash and other subjects, the Mazda No. 21 and No. 50 bulbs are recommended. In this same class we have a Superflash No. 2 bulb.

5. Focal Plane shutters require bulbs which have a longer flash duration than short peak bulbs which are used with front shutters. The Mazda No. 31 has been made especially for the 3¼ x 4¼ and 4 x 5 Speed Graphic cameras. The Mazda No. 6 Midget bulb can be used with the 2¼ x 3¼ Speed Graphic very successfully. The Superflash No. 2 is recommended for use with the 2¼ x 3¼ Speed Graphic, and the No. 2A for the 3¼ x 4¼ and 4 x 5 Speed Graphic cameras.
6. Finally we have the larger flashbulbs which are recommended for Open flash photography, and, in some cases, for synchronization at slower shutter speeds. These bulbs are also useful in making color flash pictures. They include the Mazda No. 50, No. 75 and the Superflash Nos. 3X and 3.

A complete description of all flashbulbs and their characteristics is given in THE PHOTO-LAB-INDEX, published by Morgan & Lester.

Open Flash Exposures

There are many opportunities to use the open flash technique of exposure. If a foil-filled flashbulb such as the Mazda No. 21 is used, the flash duration of approximately 1/40 second is sufficient to stop any slight motion of the subjects. With this open flash technique of exposure, the full light output is utilized. Of course, any of the wire-filled bulbs such as the Mazda No. 16A and Superflash bulbs can be used for open flash photography. However, these bulbs have a slightly longer burning time and will not stop as much motion in open flash exposures as the foil-filled bulbs.

The new SM midget bulb is ideally suited for open flash work with its quick flash peak of only 1/200 second.

The foil bulb has a narrower flash peak than the wire-filled bulbs. These foil bulbs can also be used for contact flashing. Thus, when one or more foil lamps are placed within ½ inch of the central flashing lamp they will be ignited without current through a transfer of the radiant energy from the central bulb. It should be observed, however, that there is a time-lag of .013 seconds before the additional foil bulbs are flashed. This means that a large concentration of light can be made for the open flash technique of exposure. Contact flashing is not recommended for synchronization at the higher shutter speeds. It should be noted that less than 60% of the light output is obtained from bulbs flashed by contact.

The Mazda wire-filled lamps are designed to be flashed by batteries only. For general all-around synchronized use or for open flash shots such lamps as the Synchro-press No. 11 and No. 16A produce a fairly wide peak with extra latitude and uniformity of timing to cover variations in synchronization with relatively high output at small bulb size. The small lamp is good for medium shots, for candid and closeup work, and the larger lamps for all-around press and commercial use—for everything but extreme distance shots.

A 3-volt minimum gives plenty of safety margin for reliable flashing of all lamps. The same amount of current is required, 1 to 1½ amperes, regardless of lamp size—as little as that supplied by two pen-light cells. Usually, the flashlight synchronizer contains three cells which produce 4½ volts. With this amount of battery current up to three flashbulbs may be fired at one time when using fresh batteries. When the

21. ICE CARNIVAL, Olympics Arena, Lake Placid, N. Y. The photographing of fast action was made possible by using a focal plane synchronizer set at 1/1000 second, f/9, one long burning wire-filled flashbulb used with Fast Pan film. Photo by E. H. Pierson.

flash synchronizer is used with higher voltage such as 9-volts or even on flashing with the 110-volt house circuit, the flash starts somewhat earlier than when the ordinary 4½-volt battery is used. For open flash photography this difference is negligible. As previously stated the use of house current, and especially DC current, is not advisable.

Color Flash Photography

With the increasing use of Kodachrome and Dufaycolor films there has also been a demand for color pictures made with flashbulbs. These pictures are being made by open flash as well as by the synchroflash technique. There are several distinct advantages when using flashbulbs for color work. It is possible to use higher shutter speeds with the synchronizer when necessary and also use the short flash duration of the bulbs with open exposure. Again, there is no intense heat present when working with flashbulbs. Models can be posed with ordinary illumination; then at the moment of exposure, the synchronized flash units can be connected. The moment of super-intense illumination given out from the flashbulbs takes a fraction of a second to make the picture.

Whenever possible the open flash technique is recommended. This method consists of opening the shutter, flashing the bulb, and closing the shutter. During this brief moment, the flashbulb has given out its output; although this flash period amounts to only 1/30 second in the case of the wire bulbs, and about 1/40 second when the foil-filled flashbulbs are used.

When shutter speeds ranging from 1/50 second up to possibly 1/200 second are to be used, the synchronizer is required. Right here is where several exposure variations may creep into the picture. In the first place, the synchronizer must be adjusted properly so that the peak of the flash will be used. If the shutter is opened too soon the flashbulb will have a predominance of blue light while a late opened shutter will pick up a predominance of red light. Therefore, it is essential that the peak intensity of the flashbulb be used to full advantage. The color temperatures vary during the flashing of the bulb. The highest color temperature takes place during the peak flash and it is this portion of the light output which should be used in synchroflash color photography.

Kodachrome Flash Photography

Kodachrome film can be used very successfully with flash lighting. With all the recent improvements in flashbulbs, it is now possible to use this color film for indoor and outdoor flashes at any time. When using Kodachrome Type A and Type B, the accompanying exposure table is recommended for use with GE Mazda photoflash lamps. This table is based on the use of average reflectors with the exception of the SM, No. 5, and No. 6 Midget bulbs which should be used in the especially designed concentrating reflectors. The flash factors are given as a guide. This table also gives exposure factors for ordinary black and white film.

		FILM SPEED				
Weston		4	8	16	32	64
G-E		6	12	24	48	100
G-E Mazda Photoflash Lamp		KB	KA			
SM	Time, Bulb, 1/25, 1/50, 1/100	30	42	60	84	120
	1/200, 1/250	24	34	48	68	96
	1/400, 1/500	19	27	38	54	76
No. 5	Time, Bulb, 1/25, 1/50	70	100	140	200	280
	1/100	55	78	110	155	220
	1/200, 1/250	44	60	88	120	175
	1/400, 1/500	30	44	60	88	120
No. 6	1/100	33	48	66	96	130
	1/200, 1/250	24	33	48	66	96
	1/400, 1/500	17	24	33	48	66
	1/1000	12	17	24	33	48
No. 11	Time, Bulb, 1/25, 1/50	70	100	140	200	280
	1/100	55	78	110	155	220
	1/200, 1/250	44	60	88	120	175
	1/400, 1/500	30	44	60	88	120
No. 16A	Time, Bulb, 1/25, 1/50	80	113	160	225	320
	1/100	62	88	125	175	250
	1/200, 1/250	50	70	100	140	200
	1/400, 1/500	35	50	70	100	140
No. 21	Time, Bulb, 1/25, 1/50	85	120	170	240	340
	1/100	65	92	130	185	260
	1/200, 1/250	55	75	110	150	220
	1/400, 1/500	38	55	75	110	150
No. 50	Time, Bulb, 1/25	135	190	270	380	540
	1/50	115	160	230	320	460
No. 31	1/200, 1/250	33	48	66	96	130
	1/400, 1/500	24	33	48	66	96
	1/1000	17	24	33	48	66

KB stands for Kodachrome Type B
KA stands for Kodachrome Type A

To Find Exposure

First determine the film speed rating for color or black and white film. These ratings may be found in the latest data sheets issued by Weston and General Electric for their exposure meters. Next, locate the proper Guide number for the specific film speed, shutter speed, and flash lamp in the tables.

For example, the Guide number for Photoflash Lamp No. 11 with the shutter set for "Time, Bulb, 1/25, 1/50," in an average reflector, with a film rated at 64 Weston or 100 GE is 220. Divide guide number from the distance in feet from lamp to subject to get the recommended f/ number. At 10 feet, 220 divided by 10 gives 22, use f/22; at 20 feet, 220/20 = f/11, etc.

Dufaycolor Flash Photography

Excellent results can be obtained in Dufaycolor with flashbulb illumination. There is a slight difference in the color temperature between the foil photoflash lamps like the General Electric Company's No. 21 and the wire-filled Mazda or Superflash bulbs. The 2D filter is balanced for the wire-filled lamp with Dufaycolor cut film. The following table will give the exposure values when using Dufaycolor film with the No. 2 Superflash bulb and the G. E. Synchro-Press No. 21 bulb.

PHOTOFLASH EXPOSURE TABLE FOR DUFAYCOLOR
Cut Film with 2D Filter Open Flash Exposure

Type of Lamp		Number of Lamps in Reflectors	Distance from Lamp to Subject		
Superflash	G. E.		6 ft.	9 ft.	12 ft.
No. 2	No. 21	1	f/5.6	f/4	—
No. 2	No. 21	2	f/8	f/5.6	f/4
No. 2	No. 21	4	f/11	f/8	f/5.6

The No. 2 Superflash Lamps are rated at 56,000 lumen-seconds. As the No. 3 Superflash Lamp rates at 140,000 lumen-seconds, from 2 to 3 times less exposure is needed when these are used or increase the distance from lamp to subject.

The above exposures are satisfactory for a general guide but should be tested by the photographer to suit his working conditions. (The figures are also satisfactory when working with General Electric No. 21 Lamps, and for Dufaycolor Roll Film or Film Pack with the 2R filter.)

Mazda Photoflash Lamp No. 21B

This Photoflash Lamp, which has a blue lacquered coating, produces a short brilliant flash of light with characteristics closely approximating daylight. The lamp has been designed (1) to supplement daylight in making outdoor pictures, (2) for making exposures on Kodachrome film in studios and homes where part of the illumination is daylight which must be supplemented by an artificial source matching it in color, and (3) for making indoor pictures on Kodachrome Professional Film (Daylight Type) or Kodachrome regular film for miniature cameras. When used outdoors to supplement daylight, the No. 21B lamp can reduce effectively the lighting contrast by increasing the illumination in the shadows. When used indoors, it permits the use of Kodachrome Professional Film (Daylight Type) or Kodachrome regular film with an artificial light source without a filter.

The Mazda Photoflash Lamp No. 21B is similar in size, shape, and flash timing characteristics to the Mazda Photoflash Lamp No. 21. It is foil filled and is coated with a blue filter lacquer which absorbs some of the red radiation given off by the burning foil. By absorbing some of the red, the quality of the light given off by the No. 21B lamp closely approximates that of daylight (not sunlight). The color temperature of daylight usually is considered to be between 6000° and 7000° K. (Average noon sunlight is considered to be 5400° K.)

Exposure Data

For Mazda No. 21B Photoflash Lamp
With Professional Kodachrome, Daylight Sheet Film

These exposure data are based upon the assumption that photographs are being made in a medium-sized room with light-colored walls and ceilings. Also that the synchronizer and shutter are carefully and properly adjusted, and that an effective reflector is being employed. The table should be used as a guide, rather than as specific data.

GUIDE NUMBERS FOR GE MAZDA
PHOTOFLASH LAMP NO. 21B

(In average reflector furnished with synchronizers)

No. 21B		Regular Daylight Kodachrome Roll Film	Professional Film
One Lamp	Time, Bulb 1/25, 1/50	40	35
	1/100	31	27
	1/200, 1/250	20	17
Two Lamps	Time, Bulb 1/25, 1/50	56	45
	1/100	45	35
	1/200, 1/250	28	22

Color Photography

With Superflash Sunlite Blue Bulbs —
Nos. 0B, 40B, 2B and 3B

Superflash Sunlite Lamps are blue-coated flash lamps designed especially for color photography with daylight type color materials, such as Kodachrome 35mm Regular Film or the Kodachrome Professional Sheet Film, Daylight Type. These lamps can be used outdoors or indoors with these films without filters. When Dufaycolor, Daylight Type Film is used in connection with these lamps the green filter packed with the film should be employed, for effective recommended color correction.

For Outdoor Work. For accuracy and best results the use of a dependable exposure meter is recommended. When using the Superflash blue bulbs for outdoor work, the following table will serve as an exposure guide.

No. 0B—0 to 6 ft.—½ stop smaller than meter reading.
or
No. 40B—7 ft. and further—Meter reading as is.
No. 2B—0 to 6 ft.—1 full stop smaller than meter reading.
No. 2B—7 to 9 ft.—½ full stop smaller than meter reading.
No. 2B—Beyond 9 ft.—Meter reading as is.
No. 3B—0 to 6 ft.—2 full stops smaller than meter reading.
No. 3B—7 to 10 ft.—1 full stop smaller than meter reading.
No. 3B—10 to 13 ft.—½ stop smaller than meter reading.
No. 3B—Beyond 13 ft.—Meter reading as is.

When Kodachrome Professional Daylight Film is used Indoors, the following table is recommended. This table is computed for 1/25 or 1/50 of a second without a filter.

	Superflash No. 0B	No. 40B	No. 2B	No. 3B
6 ft.	f/5.6	f/8	f/11	f/16
9 ft	f/4.5	f/5.6	f/8	f/11
12 ft.	f/3.5	f/4.5	f/5.6	f/8
16 ft.	f/2.9	f/3.5	f/4.5	f/5.6
20 ft.	....	f/2.9	f/3.5	f/4.5
25 ft.	....	f/1.5	f/2.9	f/3.5

Synchronized Flash Powder Illumination

For many years flash powder was the only source of illumination for certain types of photography. The press photographer used flash powder almost exclusively before the flashbulbs were introduced. In spite of the wide popularity of the flashbulb there are still certain places for the effective use of flash powder.

For example, flash powder can be used for covering large areas and at the same time the powder produces a broad flare of light which tends to soften shadows. Of course, this intensity of illumination is directly under the control of the photographer. He can use various amounts of powder in each flash pan and thus determine the lumen value of the flash.

There is also the economy factor to be considered in flash powder. On the other hand, there are certain precautions to be observed especially when pouring the powder out into the flash pan. Do not re-load when the pan is hot. Also, keep the face away from the flash pan while loading.

The Victor flash powder is supplied in three grades:

1. Soft grade powder with flash duration of .12 seconds.
2. The normal grade with flash duration of .05 seconds.
3. The smokeless with flash duration of .03 seconds.

As a matter of comparison, it would take 7½ grains of soft grade Victor flash powder worth approximately 1½ cents to equal the light output of the No. 21 General Electric flashbulb. Thirteen grains of normal flash powder worth 2½ cents and 33 grains of special smokeless powder worth 5½ cents would give the equivalent values. Such charges of flash powder will illuminate fully a distance of 20 feet for open flash exposures when using super sensitive panchromatic film at f:11. The following table will give the comparative light output for 10 grains of flash powder:

10 Grains of	Soft Grade	Normal	Sp. Smokeless
Total Light Output in Lumen Seconds (Approximate)	73,500	42,500	17,000

The Victor synchronizing switch can be used for flash powder. With this device it is possible to synchronize shutters at 1/25 and 1/50 second very accurately, capturing practically the entire duration of the flash powder illumination.

While many flash powder shots are made with a hand-held flash gun, the powder being ignited by noiseless primers, illumination of large areas requiring more than one lighting unit can be accomplished with electric flash lamps for powder. The Victor flash lamps are connected to either the 110-volt electric circuits or they are fired by two 22½-volt hot shot batteries, the ignition being accomplished by small metallic wire fuses. Separate fuses can be supplied for firing the powder charges with 6-volt storage batteries.

The Victor synchronizing switch will synchronize with single or multiple units of powder charges or bulbs, plugging into the 110-volt directly without the necessity of a relay.

Exposing and Developing

The importance of exposure in flash photography should not be overlooked. It is true that the modern films have a tremendous exposure latitude; however, the nearer you can come to the correct exposure, the better will be your synchroflash results. In fact, the test for a good flash picture is to have somebody say, "Really, I can't believe that this picture was taken by flashlight." Somehow the public has become accustomed to see flash pictures which show blanched faces, starey eyes, and inky black shadows. Such photography is gradually becoming a thing of the past. With all the modern facilities and improved flashbulbs, fast films, and a wider use of multiflash technique, photographers are producing exceptional work. It is just such work which sets off the good photographer from the photographer who is still slow to make improvements in his technique.

The flashbulb manufacturers have compiled very complete exposure tables for use with all their flashbulbs. This information is available directly from the manufacturers or the complete information and tables may be found in THE PHOTO-LAB-INDEX.

In determining exposures for flash photography, there are several important factors to observe. These are: know your film speed, select the proper flashbulb, estimate the distance fairly accurately between the flash source and the subject, especially under 6 feet where extreme accuracy pays, and finally, coordinate the shutter speed and diaphragm opening to complete this determining of exposure. In multiflash photography where more than one flashbulb is used the nearest flashbulb determines the exposure factor. The extra one or two bulbs usually serve as supporting lights to balance shadows and give better detail.

In developing the flash negative, care should be taken to avoid over-development which may produce a harsh contrast and thus make final printing more difficult. However, when it comes to making the final paper prints there are times when foreground subjects may be over-exposed as compared to objects in the background. During the printing this difference can be very easily balanced by the proper forcing and dodging. In other words, a longer exposure can be given to the dense parts and the lighter parts can be given a shorter exposure by the proper shading.

Conclusion

With the present development in flashbulbs and synchronizers every camera owner can now select the proper equipment for his own particular use. Once a synchronizer has been properly installed and adjusted there is no reason why it should not give many years of service.

HANSEL MIETH

SCIENCE PICTURES FOR PUBLICATION

The Public Wants Science Pictures

An introduction by Charles Breasted

"Today . . . United States and Canadian newspapers are spending around $8,000,000 annually to picture the events they report . . . (Although) this is a scientific age . . . the daily press is devoting only slightly more than one per cent of all the pictures it publishes, to pictures of a scientific or mechanical nature. Reader interest, reflecting the tempo of the times, asks for better than *eight per cent* . . ." This statement by Jack M. Willem, Director of Research, Stack-Globe Advertising Agency, was made after an intensive survey covering the publication field in relation to Reader Interest In Pictures.

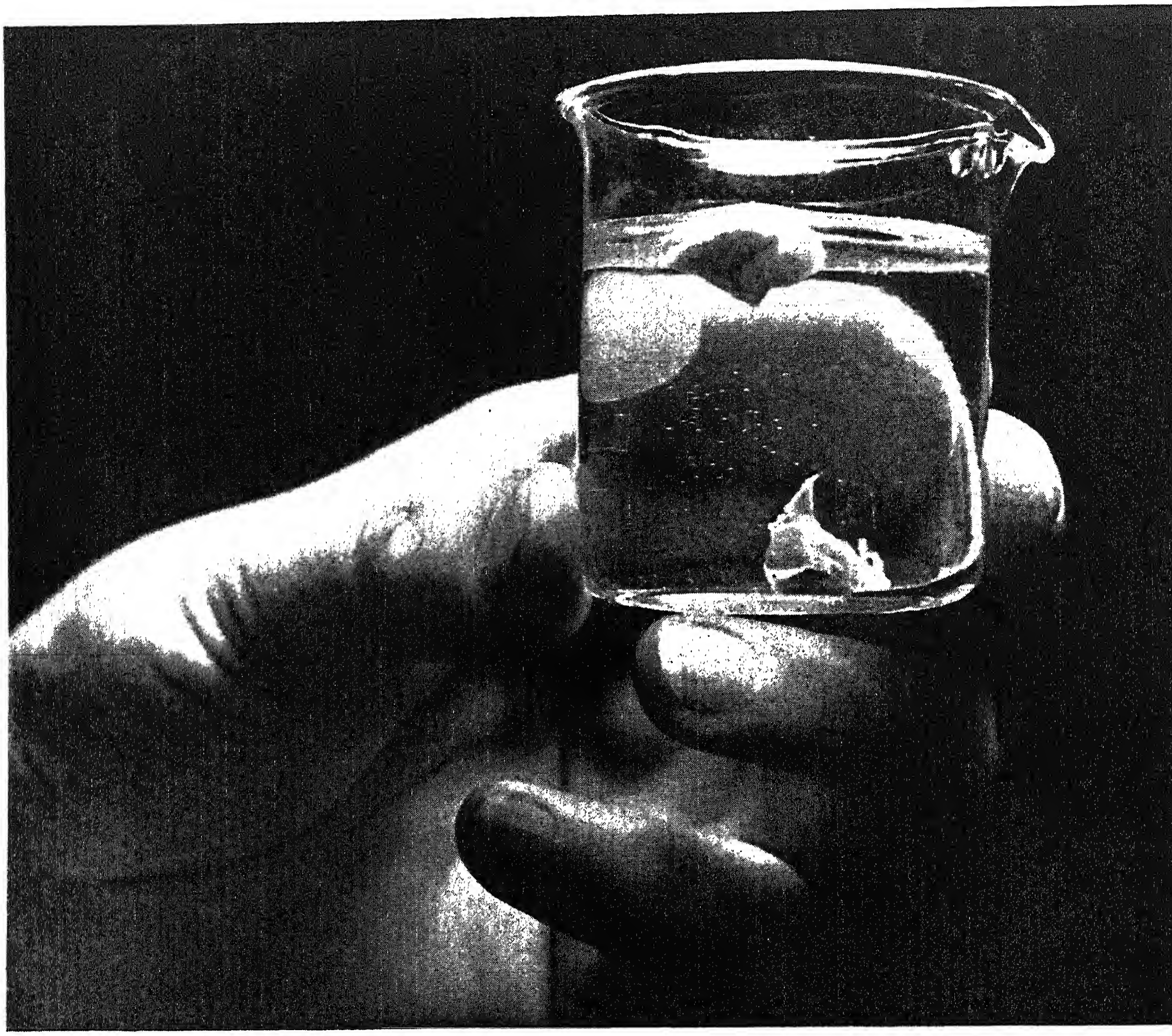
The disparity in the foregoing figures, which are based on seven years of research, must be attributed partly to editorial unawareness of actual reader interest, and partly to a general lack of proficiency on the part of most photographers in reporting scientific subjects and stories. It is the purpose of this chapter by Hansel Mieth to analyze briefly the latter problem and to present constructive suggestions and guidance growing out of personal experience, for the improvement of interpretive scientific photography.

For I am convinced that interpretive scientific photography can, by intelligently improving its standards and technique, *compel* increasing editorial attention until present estimated potential reader interest is not merely met but appreciably increased. Photography has already made itself the indispensable historian of science in its pursuit of truth, and the liaison-interpreter between its frontiers of knowledge and the lay public. This is a position of responsibility and honor. But few of us, whether we are scientists or photographers, can subsist on honor alone, and for those who depend on their cameras for a livelihood, I need hardly point out that *were* Mr. Willem's estimated potential reader interest in science pictures to be met, 8 per cent of $8,000,000 would entail an annual outlay by the press of approximately $640,000 for science pictures alone!

Obviously, such an eventuality is still a long way off. But one thing at least is certain: The field of scientific photography is literally wide open and presents greater and more interesting opportunities than any other I have yet encountered. The possibilities are limited only by the range of science itself, which now extends from the internal structure and "vivisection" of the atom as revealed by heretofore inconceivable laboratory concentrations of electrical energy, to the outer reaches of the universe as they will soon be discernible with the 200-inch telescope on Mt. Palomar. From this overwhelming gamut of photographic material, Hansel Mieth has for the purposes of this chapter arbitrarily drawn upon the field of medicine, both because it is a branch of science with which most of us have at least a slight acquaintance, and because it happens again to be one of her favorite fields of photographic exploration.

But the same fundamental principles apply in general to photographic exposition of any other branch of science. To the normally intelligent layman, science is the realm of true miracles infinitely more wonderful than his own strangest imaginings, and while his logical 20th century self tells him that these miracles are only the expression of the infallible laws of physics and chemistry, the left-over medieval or even primordial strain in his system tells him that the whole business is pretty mysterious and in the last analysis, not to be understood. It seems to me that this general inclination to regard science as mysterious and not to be understood, is one of photography's greatest challenges. The following sections and actual photographs describe the way in which one photographer has tried to meet it.

All photos by Hansel Mieth, courtesy of LIFE magazine.



1. FLOATING LUNG. In the above beaker are two pieces of guinea pig lung. The one floating on top of the water is a healthy air-filled specimen. The other sank to the bottom because it was solid from pneumonia. This photograph by Hansel Mieth was the keynote picture which filled the first page of a five-page picture feature on pneumonia appearing in the December 20, 1937 *Life* Magazine. 4 x 5 Speed Graphic on tripod was set for closeup focus. One floodlight used for illumination.

Photography vs. Scientific Lingo

By Hansel Mieth

Most research scientists have usually been so long and intensively absorbed in their specialized fields of investigation as to have evolved a whole vocabulary of their own for describing the processes, phenomena and results they have observed. After months or years of painstaking, tedious research, of checking and rechecking conclusions, such a scientist is perhaps finally able to validate his findings which he then sets forth in a paper more often than not thoroughly abstruse, and embellished with dreary photographs, diagrams and statistics. It is all highly technical and appears in some publication with a circulation confined to individuals of similar scientific knowledge and background.

The discovery may be of considerable importance to human happiness and progress. But despite the publicity offices of universities and industrial corporations which try to throw their releases into attractive, intelligible language, the news of such a discovery is still too often couched in scientific phraseology likely to alienate the interest of editors who will not always take the time to have it translated or paraphrased into lay terminology, and who inevitably find the accompanying graphs and documentary photographs as dull as the rogues' galleries.

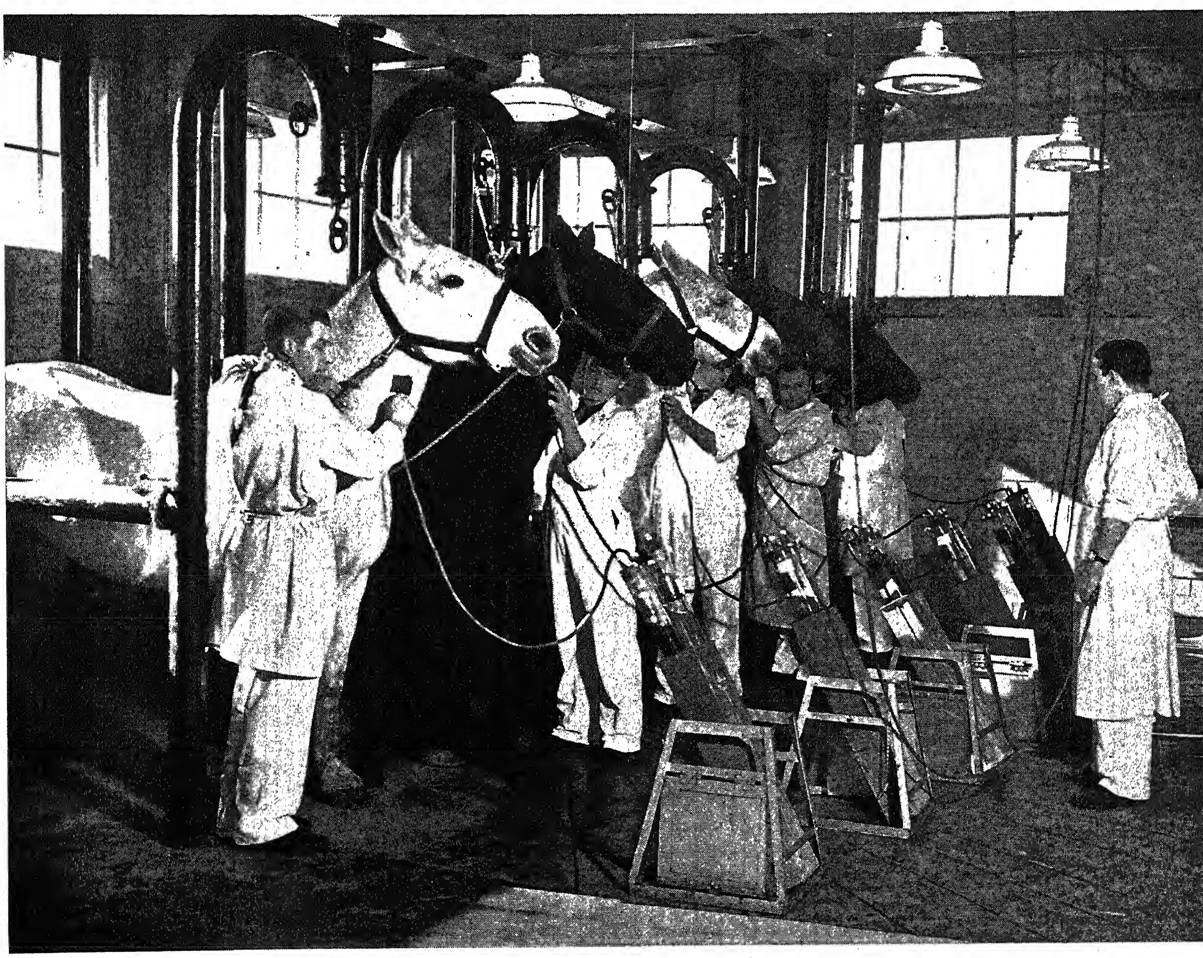
Now, it is at this point that I would like to come on the scene. For I am not a scientific investigator. I am a photographer, and the habit of seeing the world in terms of lucid pictures is as ingrained in me as is the habit of

abstruse lingo in our scientist. I naturally sympathize with him, for I myself am not preeminently articulate in *words*.

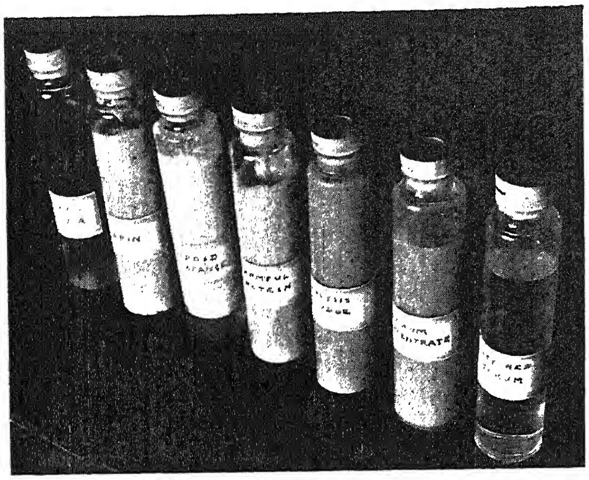
I report in photographs what I see. My job is to interpret a specific thing, idea, or situation in visual terms which will make it intelligible to a maximum audience of every age and of infinitely diverse education and background. My approach to a subject has to be at once specific and general: I must find the descriptive denominator which is common to the greatest possible number of my audience. I have to resolve words and ideas into a situation, a tangible presentation which can be photographed so that the resulting pictures convey exactly what I have in mind — or what our profound scientist has discovered. Wherever feasible, my photographic exposition must simultaneously convey the *implication* of what is being presented.

A picture story on a scientific subject must center around one incident which can be dramatized and has enough photogenic qualities to serve as a focal point for the entire exposition. Determination of this focal point is the most important and difficult part of the job. It may in itself be a tangent off the actual subject, or an expansion of a particular segment of research. But whatever it is, it must permit of dramatization and must result in pictures of maximum visual impact.

The finished photographs must tell at least half the story, and by arousing curiosity, compel a reading of the accompanying explanatory caption containing that portion of the story which it is impossible to convey in the photograph itself. In this way pictures and captions complement and integrate with each other, and make possible the exposition of difficult subjects in a manner which almost anyone can understand.



2. HORSE BLOOD. Every two weeks technicians of the Lederle Laboratories draw off from each horse two gallons of blood containing antibodies which are in turn used to make the serum for the specific type of pneumococcus originally injected into the horse. This picture formed a significant link in the picture feature covering this subject. Multiple flash exposure using two flashbulbs. 1/100 second, f:16, Fast Pan film.

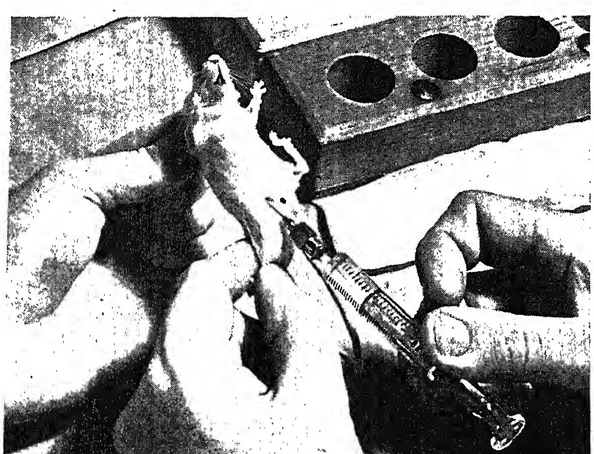


3. **PNEUMONIA SERUM SAMPLES** representing seven main steps in producing refined pneumonia serums. The final refined serum is to be seen in the bottle at the right. Two floods for illumination.

A Photographic Example: Pneumonia Serum

Lest the reader accuse me of excessive generalization, let me describe a specific assignment which I actually executed, including the method I followed, and a few of the incidental minor tribulations and heartburns which do not appear in the photographs hereinafter reproduced!

Near the end of 1937 the Lederle Laboratories were ready to market four types of serums for the 32 types of pneumonia which Georgia Cooper had classified in 1932. Pioneer work had been done by the Rockefeller Institute for Medical Research. It was estimated that more than a hundred thousand people annually died of pneumonia.



4. Compare this closeup view with the general picture showing the entire layout on the opposite page. This picture lacks the complete story-telling supporting details found in Figure 5.

This newly perfected serum had the power to cut this mortality in half.

Life Magazine wanted this story for a lead, and assigned me to do it. I immediately became pneumonia-conscious. The Research Department dug up some notes taken on a previous survey, and secured the laboratory's permission for my visit. I tried to read up on pneumonia in a hurry, starting with the thinnest books I could find, for time was short. The *Britannica* told me what pneumonia is: an acute inflammation of the lungs caused by bacilli called pneumococci. But it told me nothing about serums.

My mind mulled over the words pneumococci serum. Serum, blood. Something that went on inside of the lung. Something clogging it, distending it, preventing it from functioning. How could I show *that?* Microscopes — sick lung — healthy lung? Probably not dramatic enough. How about photographs showing amount of air sick lung takes, compared with normal lung? Not too good, but maybe.

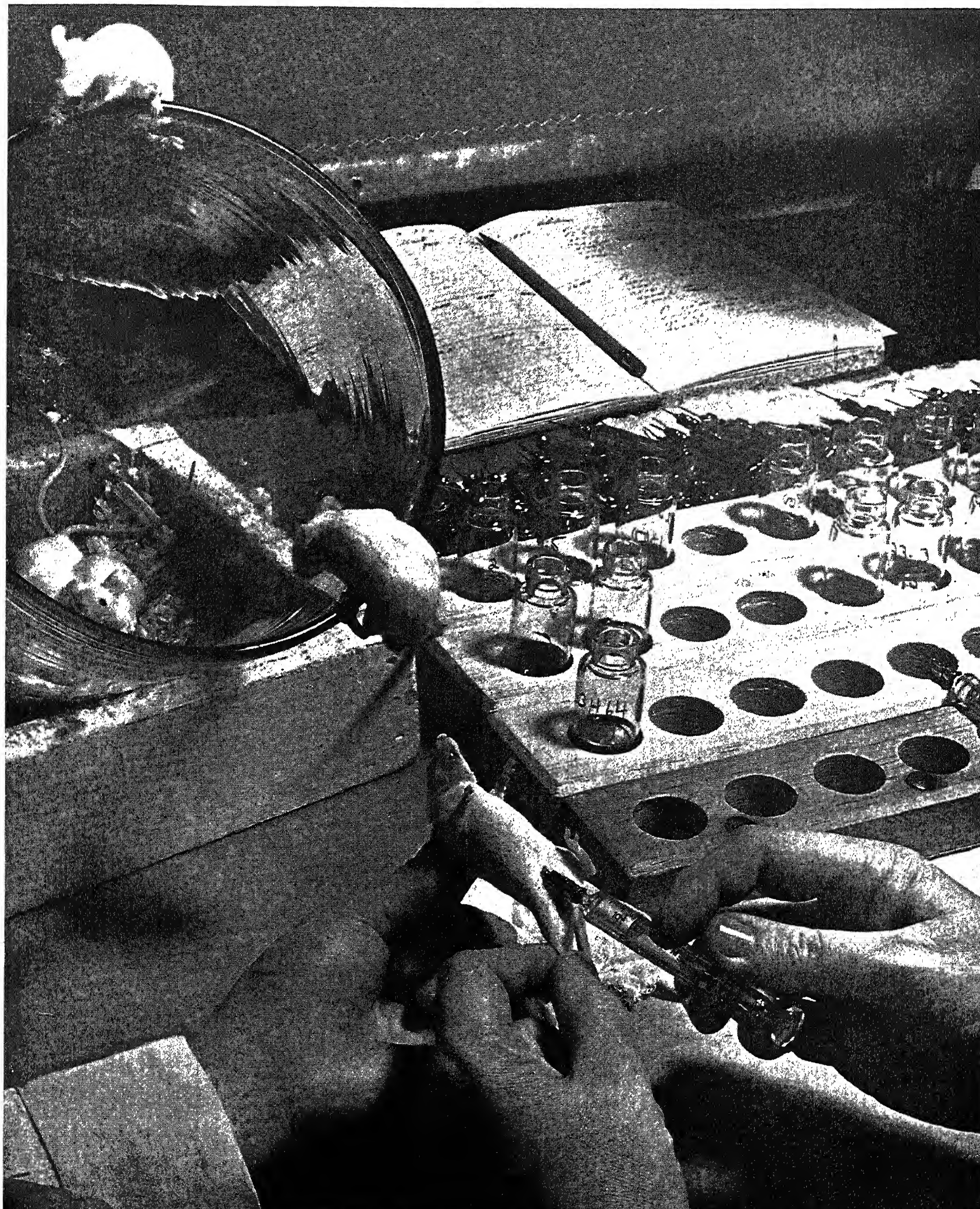
The problem was to show how pneumonia serums were obtained, tested, and how they worked, including typing and administration of the serum. While I rode to the laboratory, I ran over my notes again: horses, mice, guinea pigs. Centrifuges, controls, syringes, microscopes, sterile containers, pulmonary cavities. My mind suddenly wandered from pulmonary cavities to gastric voids. Where could I get some lunch?

But lunch was a mirage. I had reached the Laboratory: How do you do, pleased to meet you, how are you, where would you like to start? Thank you, I'd rather walk around a bit to familiarize myself with everything. This way, please. Meet Mr. So-and-So—this is *Life*, going to take pictures in your Department. How do you do, pleased to meet you. Meet Miss So-and-So—follows conversation ditto. You ought to take a picture of This, they insist. And of That. Thank you, I want to look 'round first. See you later.

I go through twenty departments, meet twenty department heads—pleased-to-meet-you, how-do-you-do-conversations ditto. I get a bookful of notes, see perhaps three pictures.

Tripod, camera, synchronizer, where is that Film Pack? Tables, reflectors. Let's do this first. Please, just keep on doing what you were doing. Don't pay attention to the camera. Act as if I weren't here. No, please look serious . . . just go ahead with your job . . . you can move about as much as you always do. Bend down a little more. No, not so much . . . that's better. Well, here goes one. Click! Let's get one or two more (first one was on the slide, anyway!) Guess that'll break your camera, he says. I swallow the words, Don't flatter yourself. . . .

I work like the devil for a long time. I begin to see what I want. Staff people gabble at me, meaning to be friendly: You ought to take a picture of this. Of that. I am sure this is something the readers of *Life* would be interested in. And so on. I look at my watch: I'm late



5. PNEUMONIA SERUMS TESTED WITH MICE. This picture solved a very difficult problem to illustrate the stage where all serums are tested during manufacture as well as just before delivery to hospitals. Note the sharp closeup detail in foreground as well as the background. The acrobatic mouse on the edge of the glass helps to give a certain liveliness to a picture which might otherwise have been ordinary. 4 x 5 Speed Graphic, about 4½ feet from subject. 1/50 second, f:16, one synchronized flashbulb, Fast Pan film.

6. A PATIENT RECOVERS. This amusing picture completed the pneumonia serum feature. This patient was feeling perfectly healthy five days after taking the pneumonia serum injections. Two flashbulbs synchronized with camera.

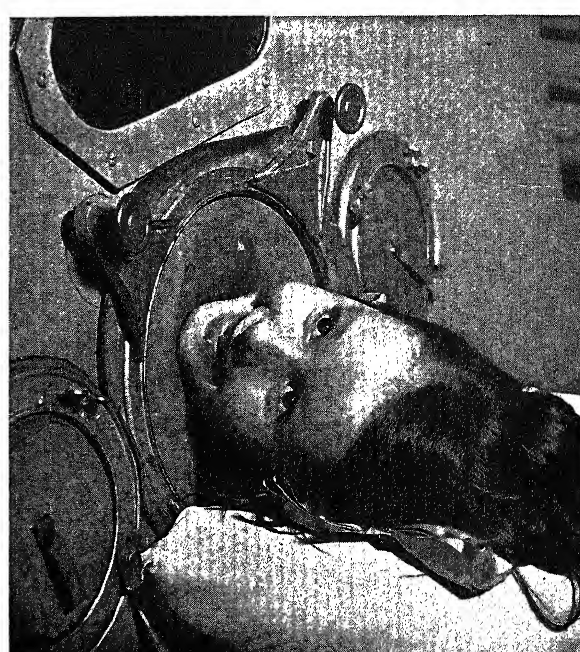
for the centrifuge department . . . never did get lunch. See you later.

Once more, set up, focus, stop down. shutter setting, film pack. Did I pull the last exposure? Pull one extra for luck. This is Mr. Kandid, he is also a photographer. How do you do, glad to know you. I am only an amateur, of course. What do you think of the Argus? I answer, Would you mind changing this bulb for me. Woops! Sorry you burned yourself—forgot to tell you they get hot . . . When will these pictures appear in *Life?* Sorry, don't know.

I work faster and faster, they keep prattling. Keeps you on the go, doesn't it? Do you just travel around and take pictures? Gee, must be fun . . .

All this time I've been taking many more pictures than can possibly be used, for I know from experience that *Life's* editors — all picture editors — require wide selection. In my own mind I had already narrowed the pictorial story down to the coherent essentials I was seeking. But in order to judge the wisdom and accuracy of my selection, and to make sure that I missed nothing, the editors will want to see as much contextual photography as I can bring them. This means much wastage and extra work, but it has also had its value: for while I was shooting and shooting, the story had steadily been gaining shape. Here is the way I finally resolved it into pictures:

7. ARTIFICIAL RESPIRATION. This photograph together with Figures 8 and 9 were used in photo feature story covering vivisection. Above picture shows experimental work on a cat in miniature respirator.



8. As a result of preliminary tests on animals this little girl is able to live. Closeup flash picture to show the iron lung which creates artificial respiration.

Hand Holding Glass With Specimens of Sick and Healthy Lungs

How does the sick lung differ from the healthy lung? After several different attempts, using microscopes and complicated apparatus, a laboratory attendant suggested placing fragments of guinea pig lungs in water. Healthy specimens will float, but sick specimens, loaded with pneumococci, sink to bottom of container. This proved most striking, easiest assimilable comparison, had the best pictorial possibilities. It could be understood at a glance.

Bleeding Horses

I was confronted with a group of horses which had given hundreds of gallons of blood for serum. The problem was to show how the blood was obtained. For my solution of this, see Figure 2.

Tubes

Between the blood-stage and the serum-stage lay six or seven steps, some of which I photographed, but not all, for they were too similar and not sufficiently interesting. I asked the laboratory to put the products of each step into a test tube and to label it. Thus with one photograph I could show various necessary steps in the process of arriving at the serum-stage.

Mice

The serum obtained from the horses, when completed, was tested on white mice which had been injected previously with pneumonia germs and had been allowed to develop pneumonia. The problem was to show at a glance all the elements involved in testing the serum. This included the test tubes, syringes, record books, and mice scampering about after the injection. The camera was placed so that it included all these elements but nothing more. The picture was illuminated by a single flash. See Figure 5.

Smiling Patients

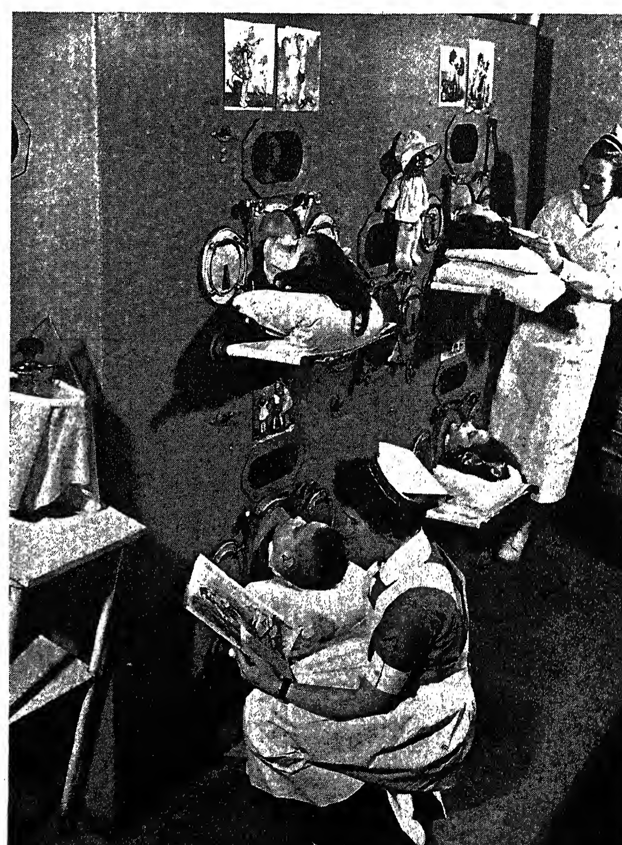
The "pay-off" picture of the human angle was one I took of a patient, at the Harlem Hospital, who three days previously had been so seriously ill with pneumonia as to require continuous oxygen treatment, had then been treated with serum and upon my arrival was almost completely recovered. The picture was lit by two flashes spaced so as to bring out the modelling in the face.

Baby Chick Sex Hormones

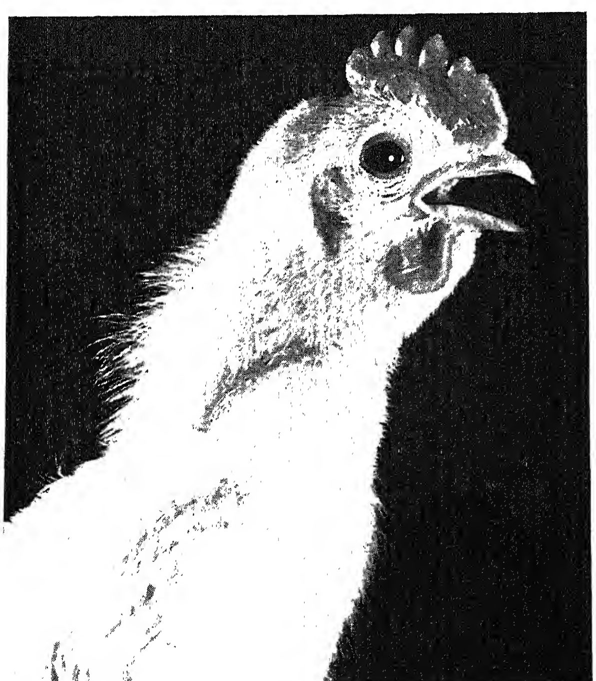
Life wanted a picture story of Dr. James Bruce Hamilton at the Yale School of Medicine shown conducting experiments with sex hormones. Besides other animals he experimented with baby chicks. Day-old chicks were injected with a solution containing sex hormones. A corresponding number of chicks of the same batch were kept as controls (not injected). After a few days it was easy to distinguish rooster from hen among the injected animals, while the control group remained alike. The injected rooster assumed very cocky characteristics, flapping its wings, strutting and attempting to crow. At the end of the week, secondary sexual characteristics were well developed, the little rooster had a fine comb, full wattles and a loud, if unsure crow. My job was to show this development, contrasted with the control.

A flock of chicks bunched together in a cage are difficult enough to photograph, but to single one out in the group while crowing proved nearly impossible. I attempted to focus with a floodlamp, which made the chicks tired, and they squatted down and paid no attention to me or each other. If I crowded them too much in one corner the little males didn't feel like crowing. After a time of luckless experimentations I remembered seeing a rooster crow from a post, and it gave me an idea. From the technician in charge I obtained a quart bottle, with a screw top, which was just big enough to act as fence-post for my little rooster. I picked one out

9. A full view showing four happy healthy looking children in iron lung which has saved their lives. Two flashbulbs used for making the exposure. 1/100 second, f:16, Fast Pan film.



10. STRONG MAN BLOOD DONOR. This photograph was used in a blood transfusion feature. To give the appearance of dominating strength, Hansel Mieth placed one flashbulb below the knees of this blood donor, producing dramatic lighting as he poses.



11. This picture of a week-old chick after receiving sex hormone injections developed rooster's comb and longer feathers in back of neck. See page 315 for complete description. Two flashbulbs, 1/200 second, f:22, Fast Pan film.

and placed him on this perch, keeping his mates a foot or so away. And pretty soon he stretched his neck and began to crow. So I took him down again and put him back in the cage. Now I looked for a match-box as a stand-in or substitute, brought my camera quite close and adjusted my lights and focused the camera. I put my shutter at 1/200 second stopped down to f:22, and set two flashes about three feet from the subject, one as a basic light and one as a key-light for modeling. After I was all set and ready to go I replaced the chick on the perch and waited for the crowing reaction to set in again. At that moment the accompanying illustration was made.

Champion Blood Donor

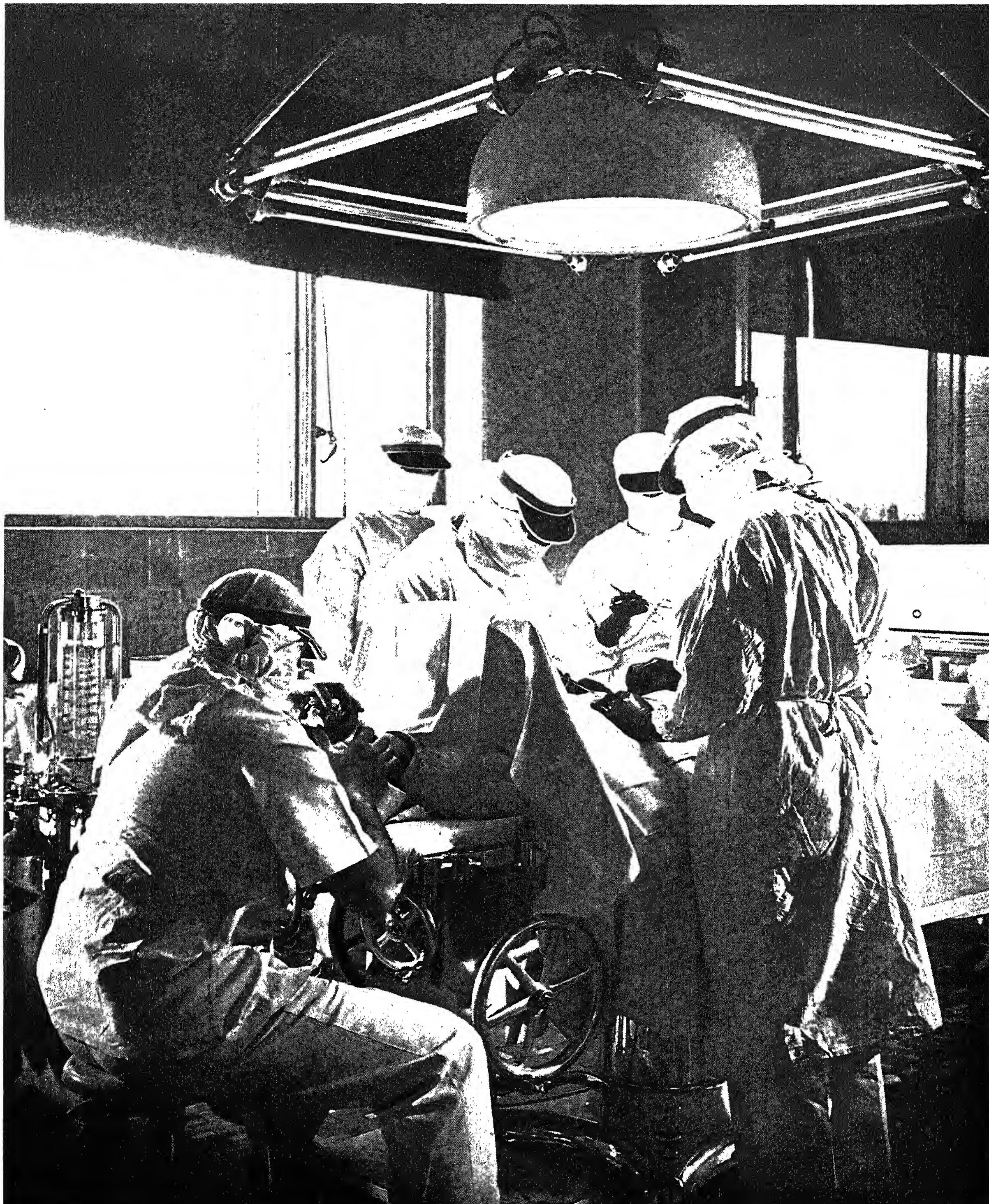
When I covered the Philadelphia Blood-bank story I needed a striking picture to arrest attention. *Life's* Research Department reported that in Philadelphia lived a man who laid claim to be the world's champion blood donor. We went to look up Edward "Spike" Howard, and found him to be the rather heavy-set gentleman shown in the accompanying illustration. He had given over 144 quarts of blood, or enough to sustain the lives of ten people. Mr. Howard eats raw steaks to build up his reserve blood supply. He informed us that he had given away all this blood without payment because he had a feeling that blood is something sacred. Among his strong-man accomplishments was the feat of breaking a heavy tow chain with his chest muscles. This suggested the picture to me. By placing my single flash reflector at a low point, I dramatized his strength into a picture which I hoped would catch the reader's eye while glancing through the magazine.

Equipment and Lighting

I have always achieved my best pictorial results by reducing my equipment to absolute essentials, and keeping those essentials in *perfect operating condition.* The items are not many.

The pictures accompanying this chapter were taken with an unimpressive-looking 4 x 5 Speed Graphic which lacks many of the more recent refinements and is much the worse for wear. But it has covered plane crashes, dancing lessons, the national budget and a thousand other varied assignments. It is solid, substantial, doesn't get out of order easily, is a good camera to work with.

I also like to use a thoroughly substantial tripod which can be relied upon to stay "put." The only thing more important than the tripod is the synchronizer, which must be the very best to be had. I must be absolutely assured that when I am all set up, waiting for my picture with one finger on the synchronizer release, it will work, "come Hell and high water!" It MUST work, and must do so infallibly even at the highest speeds of which my shutter is capable. It must be so reliable that I can forget all about it.



12. OVERHEAD STERILE LAMP. The assignment called for the photograph of a new type of lamp for killing germs. This photograph is undoubtedly one of the finest examples of Hansel Mieth's photographic technique. Ordinarily a photographer might use a straight front lighting and make the entire foreground and center white, without any detail. However, by using two flashbulbs on extensions at the right and left, it was possible to keep the center and foreground in darker relation to the operating center of the picture. This carries the eye immediately to the center of action in relation to the sterile lamp above. As this picture was taken during the day, the outside illumination through the window created another problem; however, the balancing strength of the flashbulbs offset over-exposure from the background. Three types of illumination: daylight, flashbulbs, and sterile lamp. Fast Pan film used.

13. This is how the germs cultured from one drinking glass look closeup. The closeup picture was used to emphasize the danger from germs. One photoflood bulb used for illumination.

Most of the accompanying pictures were taken with flashes, synchronized at various speeds, depending on the movement of the subject. One of the many advantages of flash photography is that no characteristics in a given setup will be changed by prolonged exposure to the heat of floodlights. With flashlight and fast film I can use a small diaphragm and get sharp definition over a larger field . . . an imperative matter in photographs of scientific subjects. For obviously, soft focus approximations permit only guesses, while sharp definition pictorially documents facts.

In general I illuminate scientific subjects exactly as one would dramatize a character on a miniature stage. The principal item receives maximum illumination, the less important items are allowed to fall into the shadows. To accomplish this often requires two or more flashes, which in turn must be placed at an angle to the optical axis, and not too near the camera. The proper position of the flashes can be determined by experimentation with floodlights on a similar object.

In conclusion, the film should be developed in a fine-grain developer such as D-76 or DK-20, to permit enlargements of sections of the negative. Development should not be carried too far, so that no portion of the negative will be blocked.

Once I have become thoroughly familiar with the working possibilities of my equipment I am able to carry out the various operations almost automatically. While good equipment is very essential to the production of fine results, one must realize that this represents only the mechanical side of publication photography. Only by completely coordinating his camera equipment with his creative interpretation of a particular scientific assignment will a science photographer give to his work an individual interpretive touch. This is one of the real reasons why I enjoy making pictures revealing scientific developments which are the result of many thinking minds. I must also have this creative alertness when making the photographs which will convey these scientific ideas to the reading public.

PHOTOMICROGRAPHY WITH THE GRAFLEX

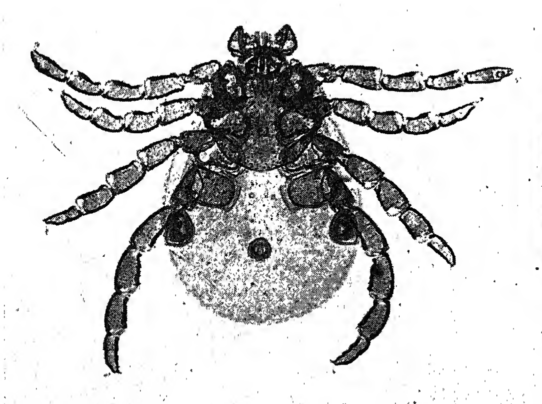
JULIUS WEBER

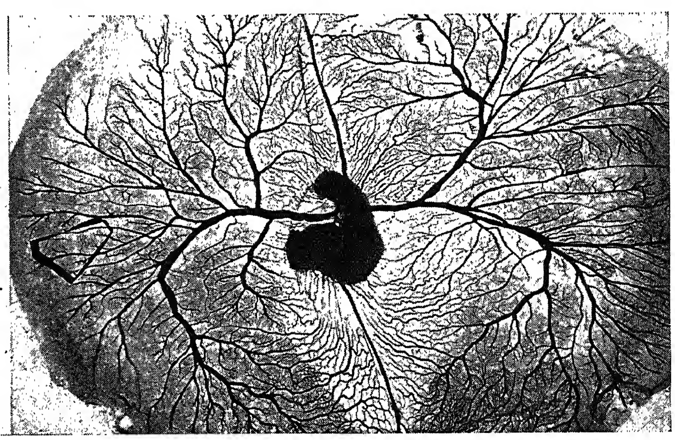
Many of the features that make the Graflex so efficient in regular photography can be used to advantage in photography with the microscope. The ability to see a critically focused image upon the ground glass, up to the instant of exposure, is of considerable advantage in some kinds of work. In others, the Graflex camera back, which makes it unnecessary for the operator to substitute the plate or film holder for the ground glass panel and to withdraw the slide before making the exposure, is the valuable feature. The externally silvered reflex mirror serves as a shield when in the focusing position and effectively excludes all light from the film chamber. Other features which add greatly to the convenience and efficiency of the Graflex in photomicrography are: it can be used either horizontally or vertically; its interchangeable cut film or plate magazines provide the simplest and quickest means for safe and efficient handling of single or multiple exposures, allowing for individual or multiple processing. The revolving back is sometimes a useful and time-saving feature, permitting deliberate orientation and re-orientation of subject matter whenever this is not possible on the stage.

Practically the only thing necessary to adapt any Graflex camera for use with the microscope, beyond the removal of its regular lens — is the cementing to the center of the ground glass side of the focusing panel of a ¾-inch circular cover-glass. This is easily accomplished after a pencil cross has been made upon the ground glass. A drop of Canada balsam is placed upon it and the cover-glass is gently pressed down and allowed to dry. The resulting clear spot permits greater accuracy for the final focusing with a magnifier.

Which Graflex for Photomicrography?

As is known to every photographer who is familiar with the microscope, all *stated* magnifications representing the product of the magnification of the objective by that of the eyepiece are obtained on the ground glass when it is 10 inches (250mm) from the eyepoint of the microscope; if the ground glass is 20 inches away from the eyepiece, the effective magnification will be twice as great. Similarly, when the ground glass is only 5 inches away from the eyepiece, the magnification will be only





1. RHIPICIPHALUS BURSA *(left)*. Genus of cattle tick, the species of which are the agents of transmission of cattle fever and other diseases. Magnification — 20 times.

2. CHICK EMBRYO *(right)*. The egg was incubated for 96 hours and the embryo injected through the blood stream with India ink. A successful injection should show the very smallest capillary network. The embryo is then cut away from the egg, fixed histologically and cleared in oil. Magnification — 20 times. Taken with 48mm Bausch & Lomb Micro Tessar.

All stated magnifications of Photomicrographs refer to the image on the 3¼ x 4¼ plate.

TUBE LENGTH — 160mm . . . PROJECTION DISTANCE: 250mm (10 INCHES)

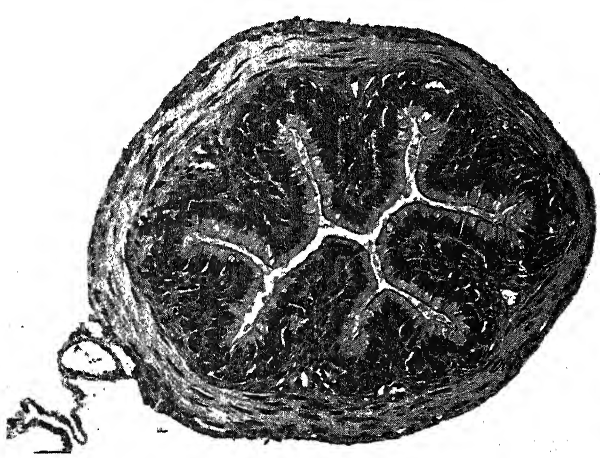
Achromatic Fluorite Objectives Equiv. Focus in mm	*Magnification No.*	Huyghenian Eyepieces or Hyperplane Eyepieces 5x	7.5x	10x	12.5x	15x	20x
48	2	10	15	20	25	30	(Hyperplane only)
32	4	20	30	40	50	60	200
16	10	50	75	100	125	150	420
8	21	105	157	210	263	315	860
4L	43	215	320	430	537	645	900
4S	45	225	338	450	562	675	1200
3	60	300	450	600	750	900	1940
1.9	97	485	727	970	1212	1455	2000
1.8	100	500	750	1000	1250	1500	

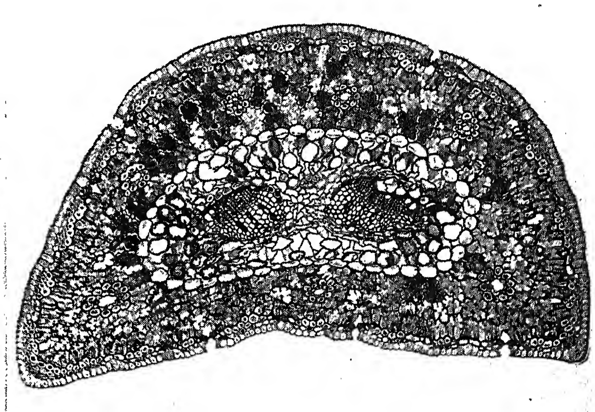
Apochromatic Objectives Equiv. Focus in mm	*Magnification No.*	Compensating Eyepieces 5x	7.5x	10x	12.5x	15x	20x
16	10	50	75	100	125	150	250
8.3	20	100	150	200	250	300	500
4	45	225	338	450	562	675	1125
3	61	305	457	610	762	915	1525
3	62	310	465	620	775	930	1550
2	90	450	675	900	1125	1350	2250
1.5	120	600	900	1200	1500	1800	3000

half that specified. In general the magnification resulting upon the ground glass is obtained approximately by multiplying the magnification for the proper objective and eyepiece combination by one-tenth of the camera extension measured in inches.

The magnifying power of the microscope is the magnifying power of the objective multiplied by that of the eyepiece. The above tables of magnifications are taken from the catalog of microscopes published by the Bausch & Lomb Optical Company.

Actually any one of the 8 currently available models and sizes of the Graflex can be used for photography with the microscope, their principle being the same throughout: differing only in size, length of bellows draw, and lens equipment.





3. SMALL INTESTINE *(left)*. Cross section through the duodenum of an amphibian showing the outer layer of muscle and the inner lining of digestive glands. Magnification — 100 times.

4. PINE NEEDLE CROSS SECTION *(right)*. A photomicrograph should show the thin layer of wax surrounding the leaf. Magnification — 100 times.

5. STAMP. A macrophotograph at 12 times magnification showing portion of a cancelled stamp. Made with a 35mm Spencer Micro Teleplat.

Those photomicrographers who require longer bellows extensions to have greater range in magnification and greater ease in working to specified magnification, will find that their choice will be confined to:

Revolving Back Graflex	*Size*	*Bellows capacity in inches*
Series B	4 x 5	10⅛
"	5 x 7	11
Series D	4 x 5	12
Auto Graflex	3¼ x 4¼	15½
Home Portrait	5 x 7	13¾

Whenever the photographer feels that he is capable of producing excellent small negatives which will yield fine enlargements — he is free to choose any other model or size of the Graflex, which has a bellows draw limit of less than 10 inches:

Revolving Back Graflex	*Size*	*Bellows capacity in inches*
Series B	2¼ x 3¼	7-3/16
"	3¼ x 4¼	8-7/16
Series D	3¼ x 4¼	8-1/4

In deciding upon the size of the negative the photographer should consider the comparative bulk of the camera in the light of working space available, cost of negative material in connection with size of developing and enlarging equipment. While the actual cost of black-and-white negative material may be considered as unimportant, it should be borne in mind that more and more photomicrographs are being demanded and produced in natural color—on Kodachrome film, which in larger film sizes is definitely costly, while still very accessible in smaller sizes.

This last consideration is probably responsible for the marked increase in popularity of the 3¼ x 4¼ size of negative for photomicrography; skilled hands will produce practically everything on a 3¼ x 4¼ plate that is needed or wanted in black-and-white or color. It should be remembered that the standard lantern slide, which is so important to users of photomicrographs, measures 3¼ x 4. Trimming of ¼ inch off the length of the negative or color transparency will permit convenient mounting of it between two cover glasses for immediate projection. When great quantities of natural color transparencies are desired at lowest cost—the 2¼ x 3¼ Reversible Back, Series B Graflex or the miniature Speed Graphic will be found useful, particularly, since it will be found that the dimensions of the really useful area of a standard lantern slide are not very much over 2⅛ x 3⅛, after matting and binding.

Camera Support and Alignment

The most important problems in making photographs through a microscope are: freedom from vibration and perfection of optical alignment of every part of the set-up which serves to direct, transmit and to receive the rays of light. Vibration in any part of the set-up, especially when working at high power magnification, will upset the focus and definition. In addition to providing perfect alignment of all parts of the photomicrographic outfit and securing substantial firmness and rigidity of support for the camera, the photographer should see to it that camera, microscope and light source should either be vibrationless or vibrate as a unit with reference to each other.

The eyepiece (ocular) of the microscope should be placed within the lensboard opening ordinarily occupied by the camera lens, which is removed for photomicrography. The eyepiece should be as nearly in the center of the opening as possible. The optical center of the microscope field should be in the geometrical center of the plate. To screen out all extraneous light, which might otherwise reach the inside of the camera, a simple, flexible and light-tight connection is provided between the microscope and the camera by means of a piece of black cloth, wrapped around the microscope tube with the aid of a rubber band. A better connection will be provided by means of a special two-piece, telescoping connector, which consists of a collar slipping over the eyepiece of the microscope and another collar which screws into the lensboard ring. This connector provides light-tight connection, is easily separable and makes it simple to center the eyepiece. It also permits easy interchangeability of eyepieces. Such a connector is obtainable from most microscope houses. Such connectors may require that the lensboard be fitted with a special flange to fit its thread. For instance, the light-tight connector supplied by Bausch & Lomb Optical Co. is made to fit No. 3 Compound Shutter Flange.

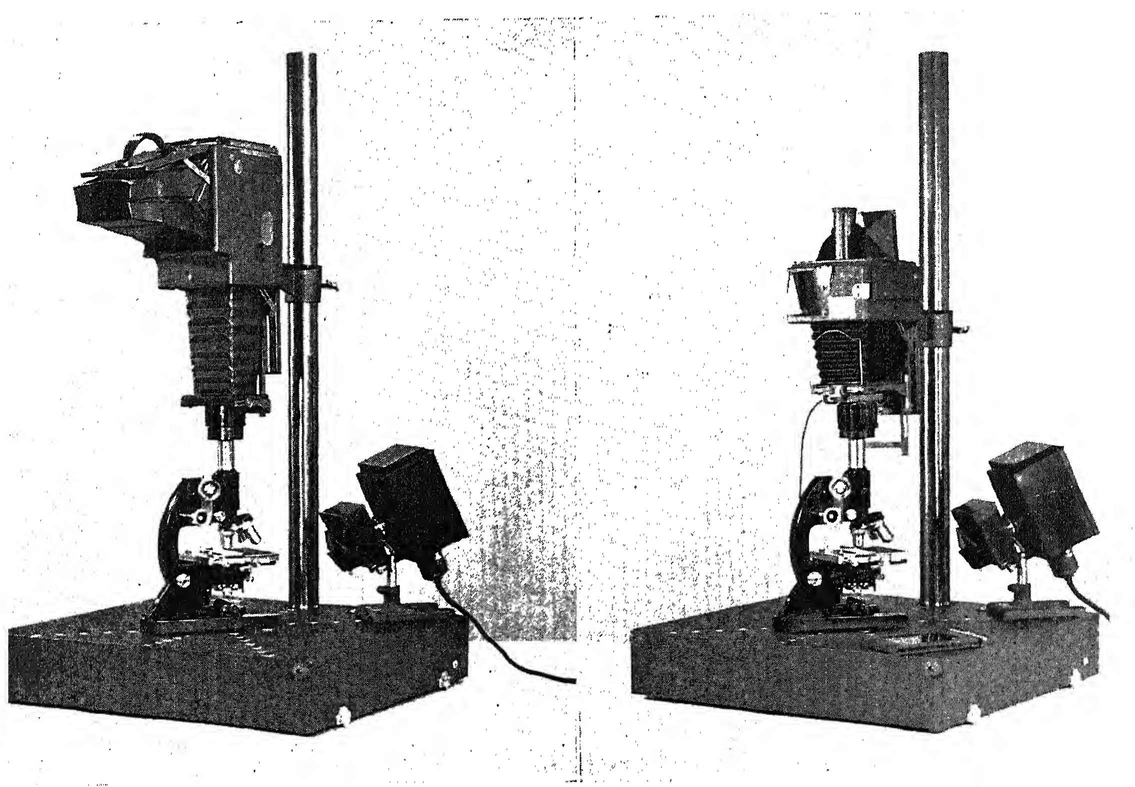
It is beyond the scope of this chapter to delve into the depths of photomicrography as such. Photography through a microscope is a profound science in itself with ramifications reaching into practically every field of human knowledge and endeavor. Photomicrographers

are usually not only required to be skillful photographers, but they must also have adequate familiarity with the theory of optical imagery in the microscope, and the technique of specimen preparation, as fixing, staining, mounting, etc., as well as a substantial knowledge of the field in which they work. It would be difficult for a person unfamiliar with pathology to find, and to isolate within a slide, the exact area of interest to a pathologist, whenever details of cancer, tuberculosis or other similar conditions were sought. For this reason only factors involving the adaptation of the Graflex camera to the field of photomicroscopy are made the subject of our approach. The reader is referred to the extensive bibliography at the end of this chapter for detailed information on photomicrography.

The Graflex can be used for photomicrography either horizontally or vertically. When the camera is to be used horizontally the microscope is tilted entirely back on its base. The light source is then placed in a straight line before the condenser, while the reflecting mirror of the microscope is removed entirely. The camera is then supported in its normal position, its focusing hood directed upward, upon a firm block of wood or metal, which can be easily produced from a rigid tripod head. This type of set-up is practical for a number of photomicrographic purposes. For an amateur, it is probably the easiest to assemble the outfit upon a long board to assure its rigidity and freedom from vibration. Probably the only type of work which could not be employed in a horizontal set-up would be floating specimens or such specimens the shape, stability or position of which are affected by gravity. Specific examples of specimens that can only be handled in a vertical set-up are a drop preparation of protozoa and small metazoa, or low-power photomicrographs of small specimens in glycerine or water.

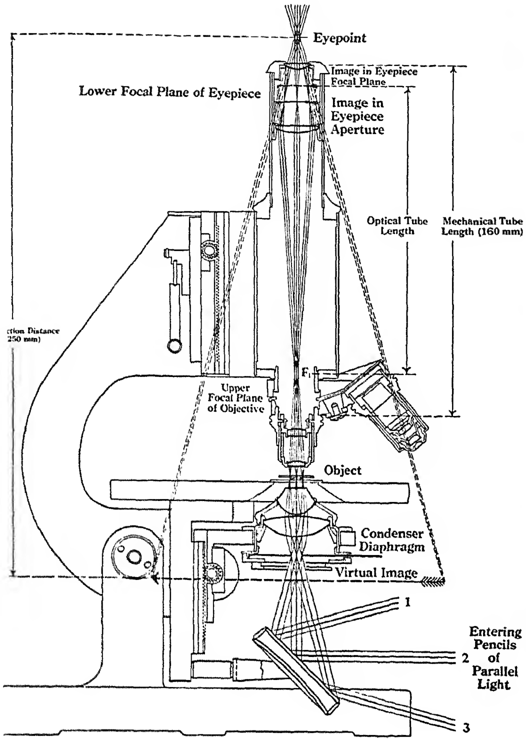
As a rule horizontal set-ups of camera, microscope and light source together with filters, etc., are best accomplished with the aid of what is known as an "optical bed" which permits satisfactory leveling, alignment and centering of each unit of the entire assembly, in one optical continuity.

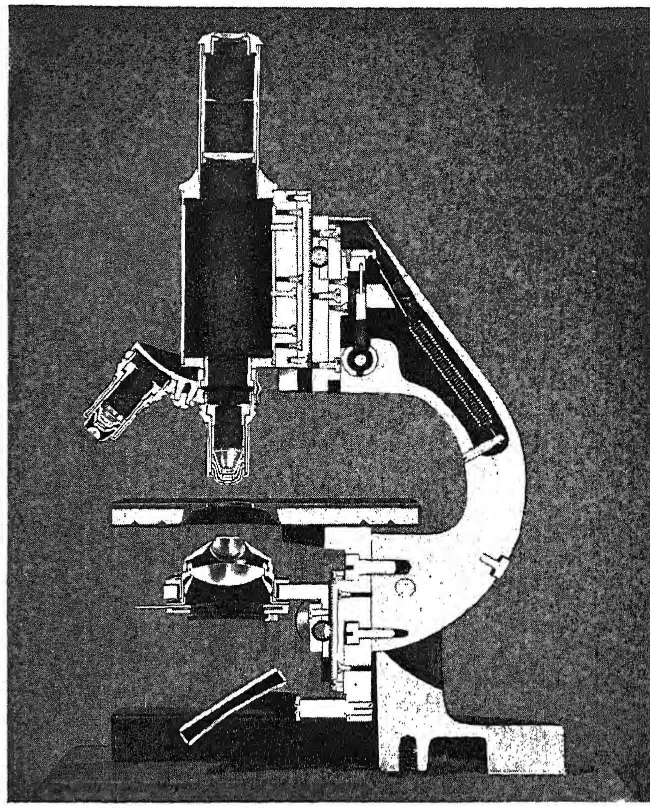
For vertical suspension of the Graflex camera, which is by



6. TWO VERTICAL PHOTOMICROGRAPHIC SETUPS. An Auto Graflex at the left and a Speed Graphic at the right, both cameras supported by the Graflex Photorecord base and upright. Note the special supporting arm available as an accessory for this photomicrographic use. A magnifier is shown placed on the ground glass of the Speed Graphic, where it is used for greater accuracy in focusing. A similar arrangement can be used with the Auto Graflex when the ground glass back is used. Note the special light-tight connector used between the Bausch & Lomb microscope and each camera.

A Bausch & Lomb Microscope lamp is shown in connection with water cell and filter holders.





7. At the left is shown the path of light in a compound microscope as set up for Visual work. In photographic work, instead of a virtual image there is a real image formed on the sensitive plate. The function of each element of the optical system is indicated in the diagram.

8. At the right is shown a sectioned Bausch & Lomb Laboratory Type Microscope such as is widely used in medical work, college and university laboratories. While designed primarily for visual work, this type has the necessary range of movement and rigidity for high grade photomicrography.

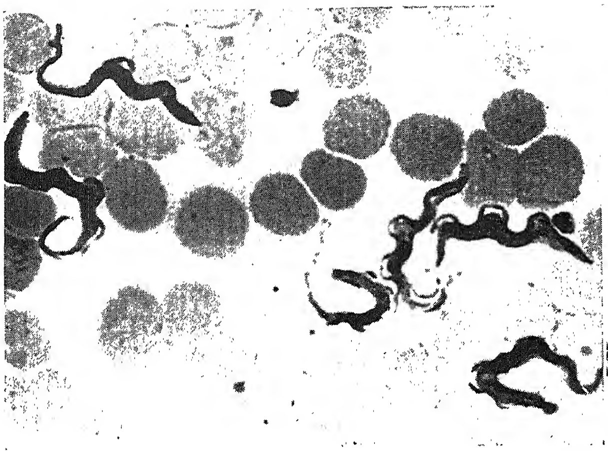
far the more universally useful, a satisfactory support is provided by the Graflex Photorecord base and upright in connection with the special Graflex camera arm, which attaches to the camera tripod screw socket. The most attractive feature of the vertical set-up, aside from its required use with floating objects, is the economy in table space, and the fact that the field to be photographed can be chosen with the microscope set up for visual observation, after which the microscope can be placed under the camera for photographic recording. The problem of alignment, centration and leveling in the vertical set-up is much the same as that required for the horizontal. If the vertical set-up, involving the use of the Graflex Photorecord base and upright, is to be employed more or less permanently, it might be well to secure the top of the upright to the wall by means of a simple fitted hanger such as is employed in the suspension of steam or water pipes or of a special collar supplied by Graflex for this purpose. This will definitely reduce any tendency for the set-up to vibrate. Such arrangement can be made to meet most requirements of stability, rigidity, and ease of manipulation.

The Optical System and the Graflex

It was previously pointed out that the camera lens is not necessary for photomicrography. The optical system of the microscope is complete in itself and sufficient for photography. It is best to think of photography through the microscope as follows: the microscope's eyepiece (ocular) projects the finished image upon the film or plate of the camera as upon a small screen. The actual image, which originates in the highly perfected optical system of the microscope objective, is subsequently modified in the eyepiece from which emerges the final image either perceivable to the eye, or to be recorded photographically, without its passing through any other optical medium. Such conception of photomicrography actually simplifies and reduces the function of the camera to that of a recording screen. Either the Graflex or Graphic camera can adequately perform this function.

To facilitate this conception of photomicrography the main component parts of a microscope are shown in figure 9 with the path of light rays appearing diagrammatically in their image-forming function.

The reproductions of photomicrographs shown in the illustrations of this chapter display the wide range of application of the Graflex camera in this field. Low, medium and high



9. TRYPANOSOMES IN BLOOD (*left*). These flagellates, which were first found in the blood of frogs, were discovered later to be the parasites transmitted by the bite of the tse-tse fly causing the dreaded African sleeping sickness. Magnification — 1500 times. Wratten No. 58 filter used.

10. FROG BLOOD (*right*). A feature of amphibian blood which distinguishes it from mammalian is the fact that the red blood corpuscles are nucleated. In man, the red cells lose their nuclei upon entering the blood stream. The white blood cell in the picture may be seen to contain three nuclei. Magnification — 400 times.

11. The new Bausch & Lomb Tungsten Arc Lamp provides excellent illumination for high-power magnification photomicrography. In this lamp the light source is the solid circular disc tungsten electrode, located in the center of an annular ring electrode. It has approximately 2½ times the brilliance of the ribbon filament lamp. It also has long life.

power magnifications show some extremely interesting specimens as employed in medicine, pathology, biology, etc.

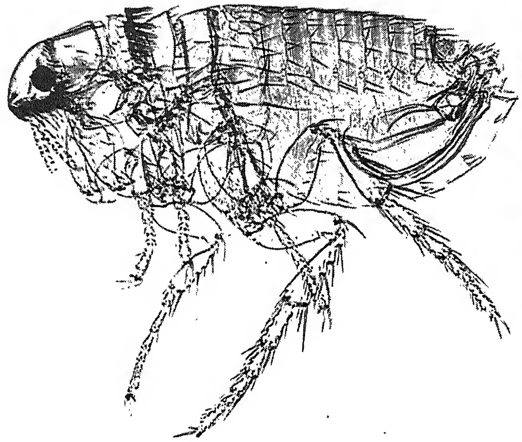
One of the most important requirements of successful photomicrography will be met by providing as nearly perfect as possible alignment of the camera film plane with regard to the microscope stage. They must be parallel. Unless this relationship is maintained at all times—it will be impossible to produce negatives of sufficient sharpness, definition, resolving power and uniformity of illumination. This can be effectively achieved with the aid of a small but accurate spirit level.

The bellows extension of the Graflex should be fixed at a definitely measured length and left at that length until a greater familiarity with the camera technique is acquired.

The Microscope

Little can be said here about the microscope itself, except that it should be as good as possible. Only a first-class instrument is really capable of yielding results acceptable in serious photomicrography. To be most universally useful, to allow its application in macrophotography as well as photomicrography, the research or photomicrographic type of microscope, equipped with a wide tube, is recommended. Macrophotography is photography of comparatively low-power magnification, which is usually done without the aid of the eyepiece of the microscope. When the eyepiece is used, *it* determines the diameter of the photographic field.

Macrophotography is made possible with the aid of special photographic objectives known as Micro Tessars or Micro Summars, which are short focal objectives available in such focal length as 16mm, 32mm, 48mm, 72mm, and others. When Micro Tessars or Micro Summars are used for macrophotography, they are sometimes mounted on a lensboard of the Graphic or Graflex



12. CAT FLEA (*left*). Magnification — 30 times.

13. WART (*right*). Section through a growing wart, showing, in the lighter stained area, the less active skin containing sweat glands, and above the greatly thickened growing epithelium containing the distinctive whorls. Magnification — 50 times.

camera with or without special focusing mounts. The wide-tube equipped microscope permits the use of Micro Tessars which are used without eyepieces for low power work requiring large fields. These provide interesting possibilities for photography of insects, parts of flowers, small anatomical specimens, metal fractures, textiles, etc.

Whatever the type of work, the microscope selected should be very rigid and heavily constructed. It should have a mechanical stage, or, if it is not so equipped, a detachable mechanical stage should be secured. A mechanical stage is a definite necessity for orientation or re-orientation of the specimen and, to be most useful, its lateral and longitudinal movements should be equipped with vernier scales and rack-and-pinion control knobs. If a microscope is being acquired for visual work with the intention of using it for photomicrography also, it is suggested that it be equipped with centering substage arrangements which are highly desirable. Such centering facilities are essential in critical high-power magnification work. As a rule, the more elaborately equipped the microscope the easier is the achievement of good results. However, competent photomicrographers are known to have produced excellent photomicrographic results with simple equipment. This is as true in photomicrography as it is of every other form of photography.

Illumination and Light Sources

Electric light sources have definitely displaced all others, including daylight. Modern high-intensity coil or ribbon filament lamps seem best adapted for all-around photomicrography because they are comparatively inexpensive, very efficient and are easily controlled. Their light is steady, uniform and of known intensity, which permits easy computation of exposures as well as color correction by means of filters. Incandescent lamps of special design intended for microscope lamps will be found a thoroughly adequate source of illumination for most routine work. If critical illumination is desired, the ribbon filament tungsten arc or carbon arc should be preferred. The coil filament is not so desirable because it is difficult to avoid imaging of the filament. Electric arc light, the most intense source of light available, will be found necessary for darkfield illumination work at high magnification. The new Bausch & Lomb Tungsten Arc Lamp is one of the most desirable illuminants in photomicrography when high light intensity is required.

Negative Materials

While a great deal of excellent photomicrographic work is being done on sheet film which is conveniently loaded into the Graflex Sheet Film Magazines, or, for that matter into the Graflex Film Holders—the best practice seems to favor the use of glass plates especially made for photomicrography. Glass plates offer a thoroughly flat surface. Many photographers, however, feel that the use of sheet film in holders or sheaths of the Graflex Sheet Film Magazines gives them as much "flatness" as may be required for all practical purposes, provided that the holders and sheaths are in good condition, not scratched, bent or scarred. For results of extreme accuracy and precision glass plates are definitely to be preferred, as they are subject to much less variation and change in processing and subsequent handling and storage.

In general it can be stated that plates or films with a high available contrast, such as is usually required in photomicrography, and with a high resolving power, another important prerequisite for this work, will have

a slower speed and a shorter latitude than those in which these latter properties have been deliberately developed to a higher degree. Contrast and resolving power being of such great significance to the photomicrographer — he is usually willing to sacrifice speed for them since he seldom requires high speed anyway as his subjects are mostly stationary. Fortunately there are now available extremely fast plates with sufficiently fine grain, such as the recently introduced Eastman Super Panchro Press Plate, with the speed required for photomicrography of motile specimens.

It is probably most advantageous for photomicrographers to standardize upon a specific negative material which has high available contrast, high resolving power and general sensitivity to all colors, such as the Wratten M Plate, which is panchromatic, and which is capable of producing a comparatively wide range of contrast depending upon its development. Its sensitivity to all colors permits the use of filters to the fullest extent for modification of contrasts. For photomicrography with blue and green light, such as is often used in metallographic work, the Wratten Metallographic Plate is recommended, which too, is a high contrast, high resolving power plate, but is orthochromatic and may be handled by red light in the darkroom. It is possible to employ a number of filters with this plate for correction or modification of color rendering or color contrasts.

With very few exceptions, practically all photographic work can be adequately done on these two types of plates. For short exposures, wider latitude of contrast and for photography of moving specimens, the newly introduced E. K. Super Panchro Press Plate will be found well suited.

Exposure

The problem of correct exposure in photomicrography is probably the most difficult to master for beginners, and not at all an easy one even for experienced workers. Since satisfactory quality of any negative in photomicrography depends absolutely upon correct exposure, it is quite impossible to suggest a substitute for it. While, as in other forms of photography, slight compensations are possible in subsequent processing of the plate, the latitude of exposure is much narrower in the material available for the photomicrographer than that available in other branches of photographic work. For this reason the method of making trial exposures has not been superseded by any other means so far.

A convenient method of making trial exposures consists of pulling out the slide of the plate holder until the plate is entirely uncovered, and exposing the whole plate a certain unit of time, for example one second. The slide is then pushed in about ¾ inch and the exposure is repeated for the same unit of time. Successively pushing the slide in, to cover equal steps, exposing each time each step for twice as long as the previous one. The plate will then have a series of steps of exposure shown: One second, Two seconds, Four seconds, etc.

Provided that most factors of the exposure can be made to remain constant, the exposures will vary directly as the square of magnification. The magnification alone is changed, if only the eyepiece or the length of the bellows draw is varied. The approximate relative exposure factors are then as they appear in the following table.

EXPOSURE FACTORS
FOR VARIOUS MAGNIFICATIONS

Magnification	*Exposure Factor*
10	0.01
20	0.04
25	0.0625
50	0.25
75	0.5625
100	1.
150	2.25
200	4.
250	6.25
500	25.
750	56.25
1000	100.

The reader must of necessity be referred to a much more extensive description of this subject, excellently handled in the book entitled "PHOTOMICROGRAPHY, An Introduction to Photography With the Microscope," by Eastman Kodak Company, Rochester, N. Y., for definite information on other exposure factors. It is appropriate however to quote the following significant passage from page 77 of that volume:

Effect of the Intensity of the Camera Image

"It is usual in pictorial and commercial photography to assume that intensity and time are equivalent factors in determining exposure, i.e., that $E = I \times t$ where E is the magnitude of the exposure, I is the intensity of the camera image, and t the time of exposure. If the image brightness is reduced eight times, by closing the lens diaphragm or otherwise, according to this rule the same quality of photographic negative as before can be obtained by prolonging the exposure eight times. It is, however, a fundamental characteristic of all photographic plates and films that they do not obey this 'reciprocity law,' as it is called. It is, nevertheless, a most useful rule when the change in the general intensity under consideration is not very great. Moreover, the departure from the values expected from the reciprocity law will vary considerably with the different plates or films. This is of great importance in photomicrography where very large variations in intensity level may occur, from those of a fraction of a second, as in low power work, to those lasting many minutes or even hours with a very dim camera image.

"Obviously the relative sensitivity of photographic materials, i.e., their relative 'speeds,' depends upon the intensity level at which the measurements are made. Those given in the table on Page 326 were measured at the 'normal camera level' corresponding to a fraction of a second with a high speed material. Speed and contrast are the two factors chiefly affected by this phenomenon. In general, it may be stated that the speed of a material will decrease if the intensity is very much lowered and the negative contrast obtained for a given development may increase."

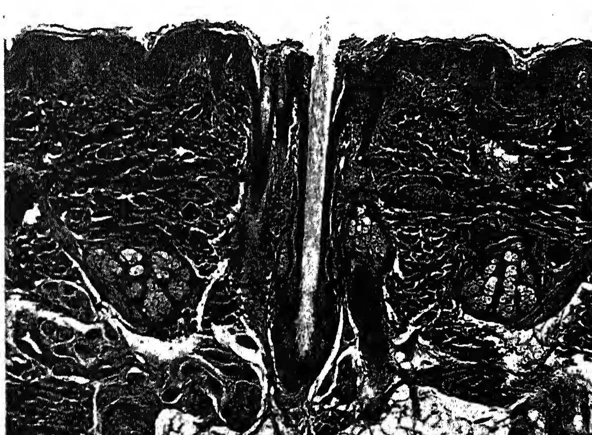
Light and High Power Magnification

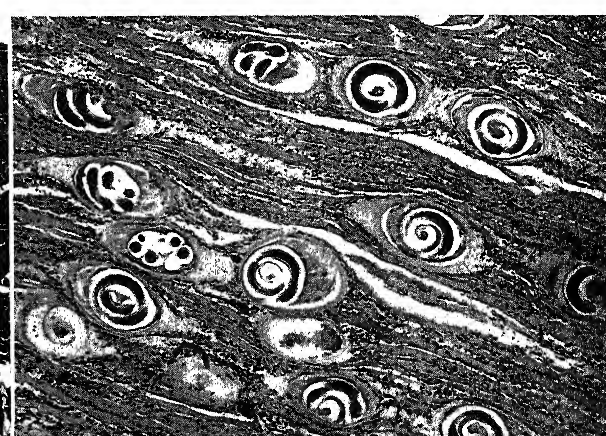
It is evident from our discussion of photomicrography through the Graflex and Graphic cameras, that in connection with the slow, high contrast photographic films and plates which are mostly used in this type of work, exposures can be made longer if preferred. It would be a good practice, therefore, to employ this point to advantage in using the Graflex and Graphic cameras in this type of work. It may develop that the employment of the reflecting mirror and focal plane features of these two cameras may occasionally result in slight vibrations, and cause unsharp pictures. This is most likely to be evident at medium and high power magnifications. For this reason it might be a better practice not to employ the reflex mirror and focal plane shutter for the exposure proper at high magnifications, but to proceed as follows. All focusing, alignment, etc., can be done with the aid of the reflex mirror with the focal plane shutter set to the "O" position. This would require the film or plate holder to be closed with its slide. When everything is ready for the exposure, the reflex mirror is made to drop out of the light path, a piece of opaque material is placed in front of the light source, the film holder slide is withdrawn, and the exposure is made by withdrawing the opaque light screening for the necessary length of exposure. The film holder slide is then replaced, and the mirror put back to its visual position to re-examine focus, if desired. If the back focusing panel is available, focusing can be done on this as it would be in regular landscape work, the light screened off, plate holder inserted, slide drawn and exposure made by removing light screen. Then replace screen and slide. Such arrangement would make it unnecessary to touch the camera at the start and finish of the exposure, thereby eliminating chance of vibration.

Obviously if a Speed Graphic camera is used for this work, the exposure can be effectively made by means of the front shutter of the camera from which both front and rear elements of the lens proper are removed for photomicrographic work.

Filters

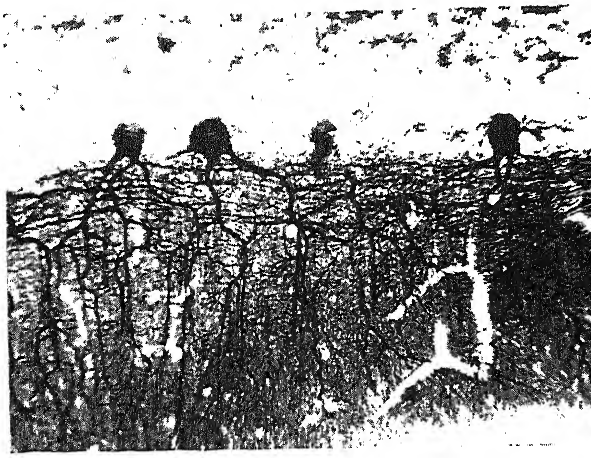
In addition to their significance as a contrast correcting medium, filters in photomicrography play an especially important role in the matter of exposure. Probably the most useful set of filters employed in photomicrography is the so called "M" filter set which is specifically intended for use in microscopy. These filters are intended for use either singly or in pairs. By using them in pairs, the light spectrum can be divided into approximately monochromatic portions. The "M" Filter set consists of the following units: A, 25; B2, 58; C5, 47; D, 35; E, 22; F, 29; G, 15; H, 45; X1, 11. Complete description of these filters as well as others employed in photomicroscopy will be found in the booklet entitled WRATTEN LIGHT FILTERS, by Eastman Kodak Company.





14. HAIR FOLLICLE (*left*). Vertical section through the scalp showing the hair follicle with three sweat glands embedded in the derma, or layer below the skin. At the very top can be seen the thin layer of dead epithelium, which has been cast off and is normally brushed or washed away. Magnification — 60 times.

15. TRICHINA (Trichinella spiralis) (*right*). The worms are shown here encysted in muscle. Trichinosis may be contracted by eating improperly cooked meat which is infected with the worm. Magnification — 250 times.



16. CEREBELLUM (*left*). A gold chloride impregnation of the Purkinje cells. The branching of the dendrites of these nerve cells is shown with great clarity after staining with gold. Magnification — 400 times.

17. NEURON (*left*). A silver and gold impregnation of the human brain stem showing a nerve cell against an intricate network of nerve fibers, traversing in all directions. Magnification — 600 times.

In addition to this standard set of filters such as that described above, photomicrography resorts to other filters consisting of flasks or special "cells" which are filled with water to which a certain amount of coloring matter is added. Thus, for instance, whenever a high intensity light source is used, such as a ribbon filament lamp, some means of absorbing excessive heat should be employed. This is necessary not only for the protection of the specimen from intense concentration of heat, but also to protect the balsam cemented objectives and the very thick lens of the modern high aperture substage condenser. A flask or a two-inch thick cell filled with water will give adequate protection. However filling such flask or cell with one per cent solution of copper sulfate, acidified with a drop of sulfuric acid, will be more effective. For purposes of intense heat reduction, a special heat absorbing glass may also be used.

Development and Processing

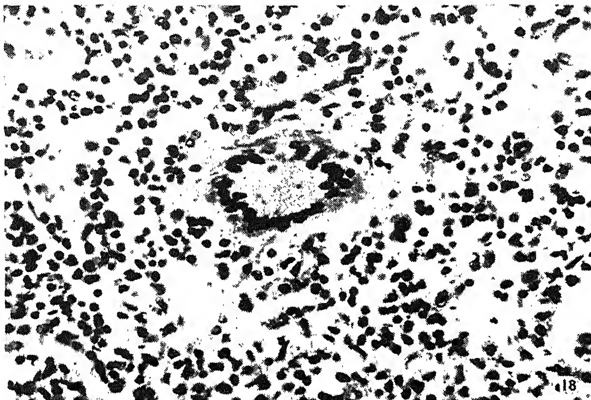
This part of the work is not much different from that recommended for other photographic processes except that in no other branch of photography is the necessity for maintaining standardized conditions of such great importance as in the processing of photomicrographic negatives. So many variables enter into illumination, light transmission and other factors governing exposure that an earnest effort should be made at standardizing as many steps of the entire procedure as possible. It is entirely within the means of the photomicrographer to adopt standard processing practices which will permit duplication of results.

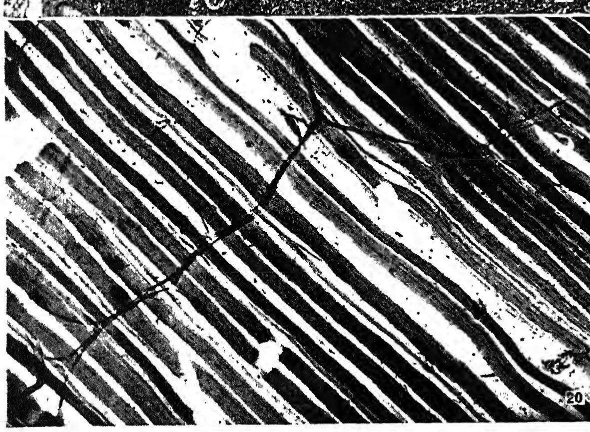
While every package of negative material employable in photomicrography is acompanied by definite processing instructions, the reader is referred to the PHOTO-LAB-INDEX as a reliable source of authentic information on standard procedures, development times, developing and fixing formulas as well as other corrective methods.

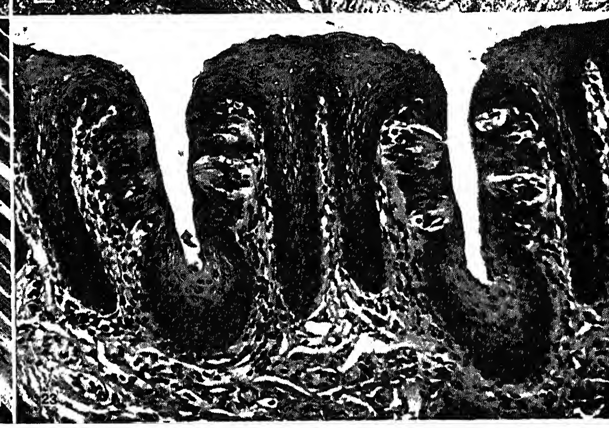
Printing, Enlarging, Lantern Slides

Practically the same applies to this part of photomicrographic finishing work. Experienced photomicrographers agree that best photomicrographic prints are secured on glossy paper stocks carefully glazed by ferrotyping. Since the over-all contrast in photomicrographic negatives is usually quite high, fine prints with excellent gradation can be easily produced on normal grades of paper. Resorting to the use of contrast grades of paper will usually yield prints which lack all intermediate tones, so significant in rendering fine details required in photomicrographs.

The photomicrographer can advantageously employ two other positive reproduction media, which other photographers have less opportunity to use. Ability to make fine transparencies and brilliant lantern slides should be as much a part of the photomicrographer's technique and competence as his ability to make good negatives. While the production of these is actually no more difficult than the making of fine prints, it definitely requires considerable experience before truly fine, rich, transparencies or lantern slides will be produced. Again there is no substitute for actual competence gained by experience, but it can be definitely stated that experience is gained very quickly because of the ease with which contrasts of gradations can be judged by transmitted light. Either the Eastman Kodak Company or the Defender Photo Supply Company, both of Rochester, N. Y., will be glad to supply interested persons with instructions outlining the step-by-step procedures for the production of black-and-white transparencies and lantern slides.







18. TUBERCULOSIS. Human lung showing typical giant cell with its numerous nuclei at the periphery of the cell, surrounded by lymphocytes. Magnification — 400 times.

19. OVARY. A cross-section of the ovary in the rabbit showing mature and developing eggs (Graafian follicles). The egg itself, surrounded by a clear space, is really floating in fluid, which has dissolved out in preparation of the section. Magnification — 300 times.

20. NERVE ENDINGS. A gold chloride impregnation of inter-costal muscle, teased and mounted in glycerine to show the nerve tracts and the end plates. Magnification — 100 times.

21. KIDNEY. Longitudinal section through the entire kidney of a new-born baby. The small dots shown are the glomeruli. Magnification — 15 times.

22. THE MEDULLA OBLONGATA shown here is a gold chloride impregnation of the nerve cells and tracts of the olivary nucleus. The slide is 30 mu. thick, and here great penetration, or depth of focus — and not high N. A. — was of prime consideration. Magnification — 60 times.

23. TONGUE. Vertical section through the surface of the tongue showing the papillae with the organs of taste, called the "Taste Buds" lining the crypts. Magnification — 250 times.

Photomicrography with Kodachrome

Essentially photography in natural color on Kodachrome film does not differ greatly from photography in black-and-white. Excellent natural color transparencies can be produced with the Graflex camera and the same set-up employed in connection with it as with black-and-white photomicrography.

At present one of the best materials available for use with the Graflex camera is the Kodachrome Professional Film Type B which is supplied in standard sizes to fit Graflex cut film holders or cut film magazines.

The chief problem in the making of natural color transparencies centers around the quality of the illumination. Kodachrome Professional Film Type B is specifically balanced for light of a color temperature of 3200°K. The General Electric Company has introduced a series of special lamps designed to meet this color temperature requirement. One of these lamps is the 500-watt T-20 type clear projection lamp which can be used in several makes of photographic illuminants. Another lamp is the 500-watt A-25 type, inside frosted, identical in appearance to the No. 2 photoflood lamp. This lamp however would require a special housing to adjust it to the requirements of photomicrography. The first of these two is to be preferred.

Of considerable importance in connection with the problem of illumination for color photography is the Eastman Color Temperature Meter with the aid of which it is easy to determine the color temperature of a given illuminant and to adjust it to the required level of 3200°K. The adjustment can be made in one of the three following manners:

1. If the color temperature of the illuminant deviates only slightly from 3200°K, the correction can be made by means of one of the set of Color Correction Compensating filters which are intended for use with the Eastman Color Temperature Meter.

2. If the deviation is substantial, one of the Wratten photometric filters of the 78 series (intended for increase in color temperature) may be used.

3. Inclusion in a given circuit of a transformer (for AC circuits) or of a rheostat (for DC circuits), and a suitable lamp to produce the modification of the color temperature to the desired level.

A slightly warmer type of illumination (containing more red at lower color temperatures) is not serious and some photomicrographers have found that the ordinary 500-watt T-20 lamp has given good results. The ribbon filament lamp is used very extensively by many workers and in many instances provisions are made to permit variation of voltage. When operated at about 8½ volts, the ribbon filament emits a light which closely approximates that required for good color correction with Kodachrome Professional Film Type B. While this will of course reduce the useful life of the lamp, if the voltage is raised only for the brief interval when the exposure is made, its usefulness will be correspondingly extended.

As a general rule the use of carbon or tungsten arcs is not recommended with Kodachrome Professional Film Type B.

Sufficient emphasis cannot be placed on the importance of accurate adjustment of the illuminating system for critical illumination in color photography. Anyone contemplating doing critical work in this field should previously acquaint himself with the fundamental principles of microscopy.

Color correction of the microscope lenses is of course extremely important in photography in natural color. Best results will be invariably obtained with the most highly color corrected lenses such as apochromat objectives with their special compensating oculars. Good condensers are also very important and the use of achromatic substage condensers is suggested for the most critical work both in black-and-white and in color photography.

It is also important not to neglect the use of the field diaphragm. In the Research Microscope Lamp such as shown in Figs. 6 and 11 provision is made for the use of a diaphragm. Some lamps do not provide this arrangement, others do. It is always desirable to limit the illumination of the subject to the area actually included in the photograph. Unless this is done, the flood of light surrounding the field being photographed will enter the lens from an angle and cause internal reflections and flare which substantially reduce the brilliance of the colors recorded on the Kodachrome film. This requirement can be likened to the recommendation for the use of a lens shade with ordinary photography, which is intended to screen off bright light shining directly into the lens. Provision should be available for the control of the size of the field diaphragm or field stop to meet this requirement. However, if makeshift diaphragming arrangements are made it should be understood that a diaphragm should not limit the angle of the illuminating cone of light beyond the actual necessity.

The control of the Numerical Aperture by the microscope substage condenser diaphragm is an important factor affecting resolving power of the objective. Except in dark-field work, there is no point in having an illuminating cone of light of an angle greater than that which is accepted by the objective. An excess results in glare, loss of contrast, etc. The substage condenser controls this angle. The field diaphragm controls the area illuminated. These two aspects of diaphragming are not to be confused.

Exposure of Kodachrome Film

Correct exposure is again of paramount significance in producing flawless Kodachrome transparencies. With certain types of subjects and with certain types of illu-

mination, it is possible to calibrate a photo-sensitive photoelectric exposure meter so that it will indicate a basic exposure time which can be modified in proportion to varying conditions. However it must be remembered that the photoelectric exposure meter can measure only the total amount of light passing through the microscope and this is not always an indication of the amount of exposure required. For this reason it has a limited application.

Since it is next to impossible to determine correct exposure for Kodachrome photography by the method of trial exposures, as is considered good practice in black-and-white photography, both because of the expense and because it is impossible to maintain a given set-up pending the return of the film from the processing laboratories, an alternative method is suggested as outlined below.

Ordinary photographic negative materials, such as Wratten M Plates, Portrait Panchromatic Film, etc., can be used to determine the correct exposure for Kodachrome Film in photomicrography, if it is remembered that the basis of judgment for the speed of a negative material is very different from that for materials developed by the reversal process as, for instance, Kodachrome.

In examining a negative to determine whether the exposure is adequate, the thin portions representing the shadow areas, or dark areas of the subject, are ordinarily used as a criterion. If the details are recorded by gradations of silver in these areas, it is assumed that the exposure is adequate. Thus, the amount of exposure required is really conditioned by the minimum brightness of the subject. In Kodachrome Film, on the other hand, the brightest areas of the subject are those which determine the correct exposure time. The exposure should be so adjusted that the light areas are recorded by a minimum dye deposit. As a consequence, when using an ordinary negative material for judging the exposure required for Kodachrome, it is necessary to consider the areas of high density. In view of the fact that the maximum densities in a negative are greatly affected by development as well as exposure time, it is at once evident that the use of black-and-white materials in this manner would involve standardization of development procedure. We would suggest that the following routine be adopted:

First of all, prepare a standard by exposing the negative material you are commonly using in your photomicrographic work in a series of steps with increasing exposure. A method for accomplishing this is described on page 83 of the book, "PHOTOMICROGRAPHY, An Introduction to Photography With the Microscope." Repeat this on Kodachrome Professional Film, send the Kodachrome in for processing and develop the black-and-white material to a moderately high contrast in a developer which can be readily duplicated. For this purpose we would suggest DK-60a, D-19, or D-11. We would recommend tray development with considerable agitation at a temperature of 65°F. The conditions and method of development should be so selected that they can be duplicated on subsequent occasions. This applies to the amount of agitation as well as freshness of developer, temperature, and time. Fixation can be carried out in the usual manner, fixing for approximately twice the time it takes to clear the undeveloped silver salts. When the Kodachrome is returned from processing it can be mounted side by side with the black-and-white material and will give a standard which can be used for reference in subsequent exposure time determinations.

It is desirable to have the speed of materials as constant as possible, and so we would suggest the use of Portrait Panchromatic Film for these tests. This gives a convenient contrast for this purpose when developed 6 minutes in a tray of D-19 at a temperature of 65°F.

With this standard in your possession, you can make an exposure of an unknown situation, develop it by the standard procedure adopted, and by laying this test beside the black-and-white negative you can decide which exposure gave a highlight density comparable with that of the test negative representing the correct exposure on Kodachrome.

Microscopy and Photomicrography

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1. EXPRESSION PEAKS . . . You will soon find that the childish expressions in joy, sorrow, and interest may last long enough for time exposures but each reaction has a certain peak of expression of shortest duration. This expression peak is exactly what you are waiting for and exercising all your skill and patience to get.

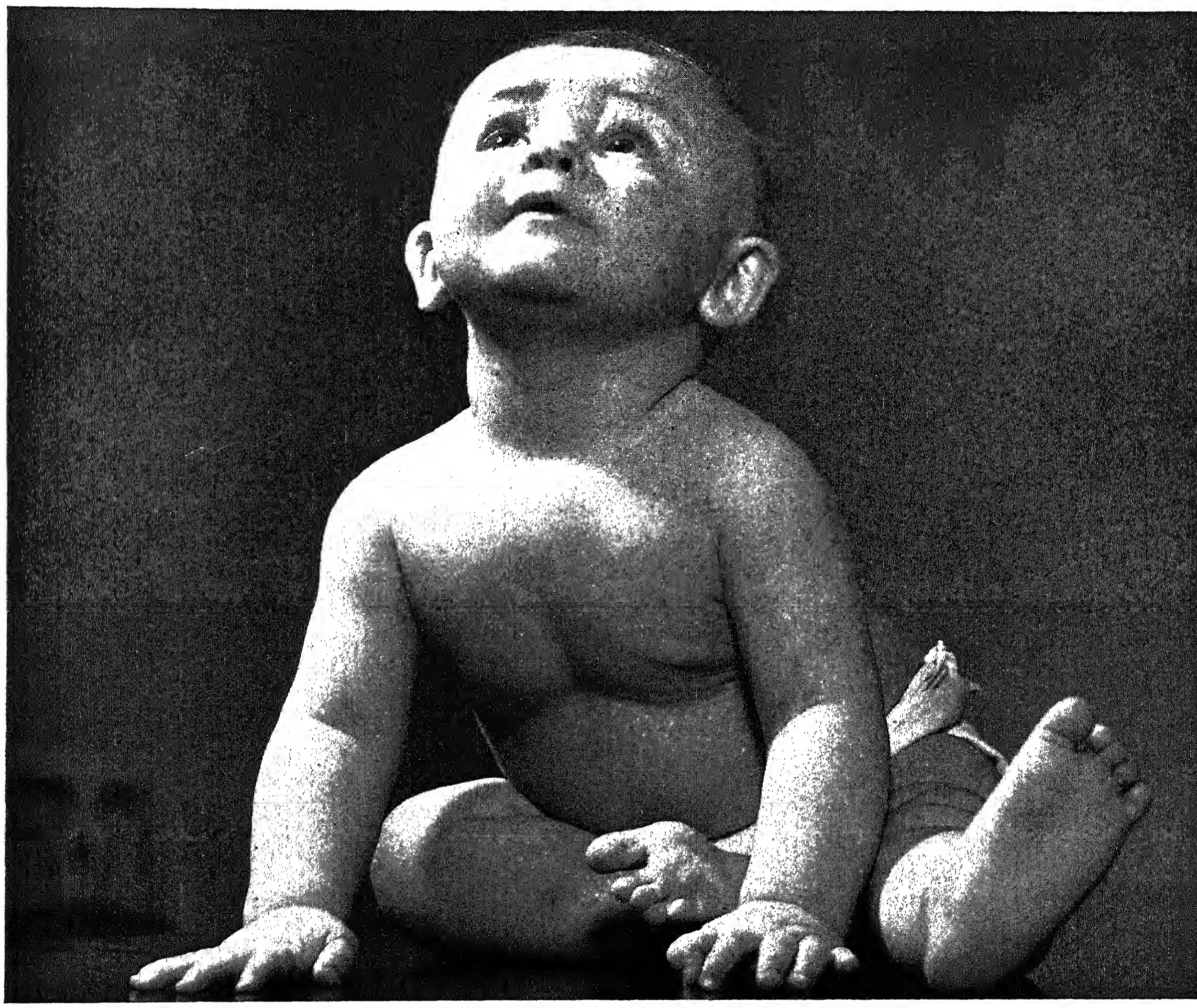
PHOTOGRAPHY OF CHILDREN

TORKEL KORLING

An Introduction to the Super D Graflex

By Henry M. Lester

The Graflex is a mirror reflex camera. Its reflex viewing-focusing optical system consisting of a single lens shows the image of the photographed subject on a ground glass, where it remains visible *up to the time* of the exposure. The image is seen erect, without parallax and in every respect like the image on the negative. The Super D Graflex retains this important principle of photography and enhances its usefulness and scope of application with two new important features: the acceptance of a lens in an Automatic Diaphragm mount and the built-in "open flash" Synchronizing Circuit.



2. The most appealing pictures of children are invariably those that reveal none of the creative effort on the photographer's part. Children are natural only when they behave so and that is what you want in your pictures. You are primarily after expressions in place of the commonplace stares and frightened looks which often creep into a child's picture.

All illustrations by Torkel Korling

3. Here is a little different "peak of expression." It expresses perhaps a sincere but happy alertness about the operation of the camera and the flash outfit. Note the naturally relaxed features about the mouth and eyes. There are no lines which helped to indicate this expression.

The automatic diaphragm control permits viewing and focusing with the lens wide open, closing it down automatically to a pre-selected aperture, while the mirror rises just before exposure. This is a highly desirable arrangement because it is most convenient to view and to focus with the camera lens at its largest aperture. The image of the photographed subject appears on the ground glass at its brightest, and, since at its largest aperture, the lens has the least depth of field, focusing is bound to be more critical and rapid. However, photographs are rarely taken with the camera lens wide open. When the picture is properly focused and composed on the ground glass, it is then necessary to stop down the lens. This is a simple enough operation, except that it takes your mind and your eyes off the ground glass at the very moment when both are needed there. It must have been during one of such trying moments that some photographers worked out a compromise arrangement, which called for only partial stopping down of the lens to the point somewhere midway between best visibility on the ground glass and best depth of field obtainable in the picture, in order to see the image of the subject *up to the very last moment of exposure.*

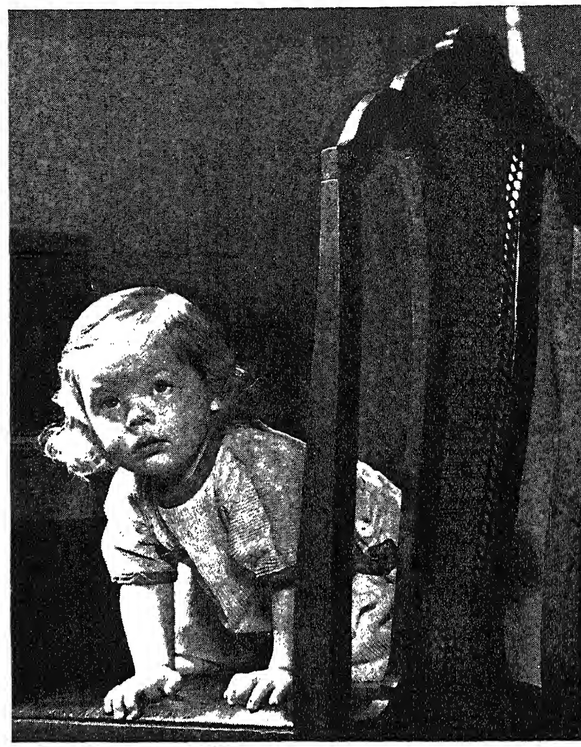
So important was this problem to some photographers that they would not remain content with this. Many of them went ahead and worked out more or less successful home-made devices for automatic or semi-automatic stopping down of the lens rather than to depend upon doing it manually. It was the superb excellence of Torkel Korling's striking photographs of children and pets, coupled with the interesting working model of his device, which fired the producers of Graflex cameras with enthusiasm to put their development and production facilities to work upon a final version of it. The automatic diaphragm available for the Super D Graflex is the result of this enthusiasm. Its operation is described in the chapter on Graflex Equipment. To still further enhance its value to photographers, it is offered together with another important

innovation: the built-in "open flash" Synchronized Circuit.

The neat black-and-chromium trim, which outwardly distinguishes the Super D Graflex from its predecessor and companion models, gives little if any indication of the truly "BIG" photographic potentialities of this otherwise modest-looking camera. The two features which account for this camera's being "different" are literally and figuratively speaking "all inside." The automatic diaphragm control and the built-in, open flash, synchronizing circuit are of cumulative value to the photographer because one without the other would limit their respective usefulness. Korling explains in the pages which follow the reasons for his camera choice for child photography. The ease of handling and the large and erect image on the ground glass are important. But, working with flash lights, as is his custom, it was always necessary for him to use his lenses at the smallest possible aperture, ranging between f/16 down to even f/32. At these lens stops, with ordinary room illumination, it is almost impossible to evaluate the dim ground glass image for critical focusing at such small apertures.

The automatic diaphragm control overcomes this completely. Essentially, this is how it works: The lens is fitted with a spring-actuated diaphragm and is normally held in the wide-open position by a catch. When this catch is released, the diaphragm closes itself down. A movable stop can be pre-set by the operator to whatever aperture is selected for correct exposure. When the exposure lever on the side of the camera is pressed, the catch holding the diaphragm open is released through an internally concealed linkage, and the lens diaphragm snaps down to the preset aperture in the short time that the mirror is rising, and just before the shutter starts on its trip across the focal plane.

The usefulness of this device is obvious. The lens is always wide open for focusing. Closing to the predetermined aperture is fully automatic and cannot be forgotten. The camera handles with the ease of a twin-lens reflex with two important advantages over it: first, since focusing is done through the taking lens, there is no problem of parallax; second, the generous size of the ground glass image, identical to that of the negative, makes for easy focusing and composition. Should one desire to determine visually the depth of field at the pre-selected aperture, the catch holding the lens open is easily released. The mirror release lever is depressed slowly, part way, until the diaphragm closes: further pressure on the lever will release the mirror and the curtain. After the depth of field has been determined, the picture may be taken directly, or the lens re-opened and again placed under



4. CONTRASTS . . . Familiar objects used by grown-ups have an exaggerated proportion when used by children. In this case, the high-backed chair accentuates the tender age of this youngster.

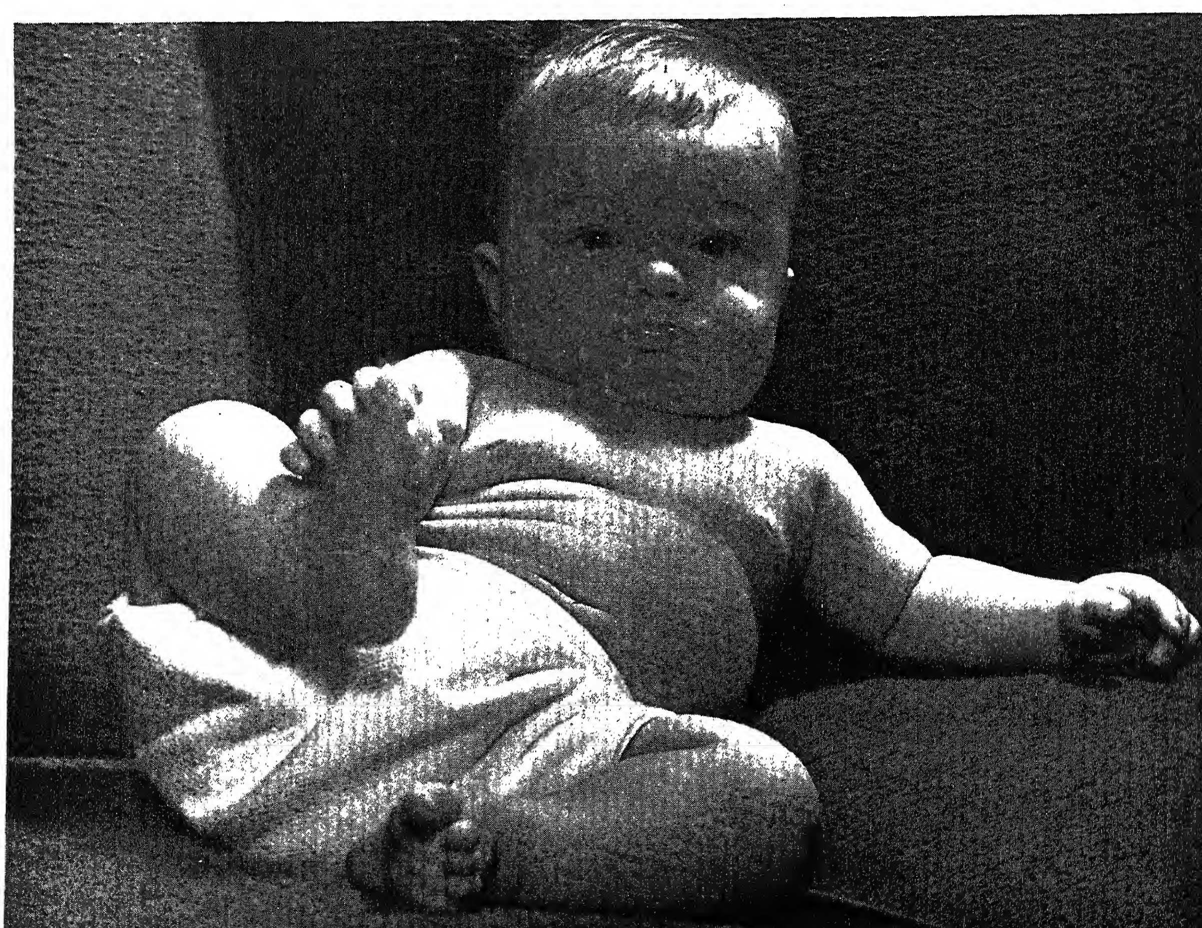
5. TORKEL KORLING in action stalking one of his subjects with a Graflex camera equipped with synchroflash outfit and special folding extension arm for reflector. Gordon Coster Photo.

automatic diaphragm control. None of the advantages of the earlier models of Graflex cameras are sacrificed in the use of the automatic diaphragm control.

While the new camera was being developed, Korling suggested that a flash-synchronizing circuit be incorporated as part of the Super D Graflex. To this end a socket and an electrical circuit with safety switches have been built into the camera. As the mirror release lever is depressed, not only is the automatic diaphragm control actuated but an electrical circuit switch is closed. When the mirror reaches the end of its travel, another part of the circuit is closed, thus causing the flash bulb to ignite. These two switches make it possible to insert the bulb into the socket even with the mirror in the raised position without the danger of accidental ignition of the bulb. The system is arranged to ignite the bulb at the proper time after the mirror is released so that the entire flash takes place before the curtain closes. The effect is, therefore, that of an "open flash" and the exposure time is determined by the flashing time of the lamp. Thus, special long-peak or focal plane flash lamps are unnecessary, while an effective action-stopping exposure time of 1/200 second may be obtained by the use of the economical and efficient Mazda Midget SM flash lamp.

The Super D Graflex is furnished with the built-in "open flash" synchronizing circuit working only at the shutter speed of 1/5 second. This means that the electrical circuit will be closed only when the width of the slit of its curtain is set to "0" and the tension sent to "1." Where ultra-speed action pictures are desired, these can be obtained by using the Kodatron Speedlite for an illuminant which will produce effective exposures ranging between 1/10,000 to 1/30,000 second, even though the focal plane shutter of the camera produces a 1/5 second exposure.

The use of the automatic diaphragm control obviously is not limited to pictures taken indoors with flash lamps or with the Kodatron Speedlite. The high speed of modern films frequently calls for extremely small apertures outdoors in bright sunlight or at the



6. Children and babies are the most universally liked creatures in the world. Children's expressions or reactions might easily be compared to the curve of the flashbulb. In this case there is a moment of contact or initial stimulus which takes a certain time lag duration before the build-up of explosive peak of laughter, sorrow, wonderment and other emotions.

7. Here is a good example of "peak of expression." The tongue helps to accentuate the spontaneous expression. The picture does not suggest, however, how difficult it was to obtain just this view. Several hours of patient work produced only this picture.

beach. With the eye accustomed to such bright light, it becomes difficult to see the image properly within the hood. With the automatic diaphragm control, the lens is always focused while wide open, providing a brilliant image on the ground glass.

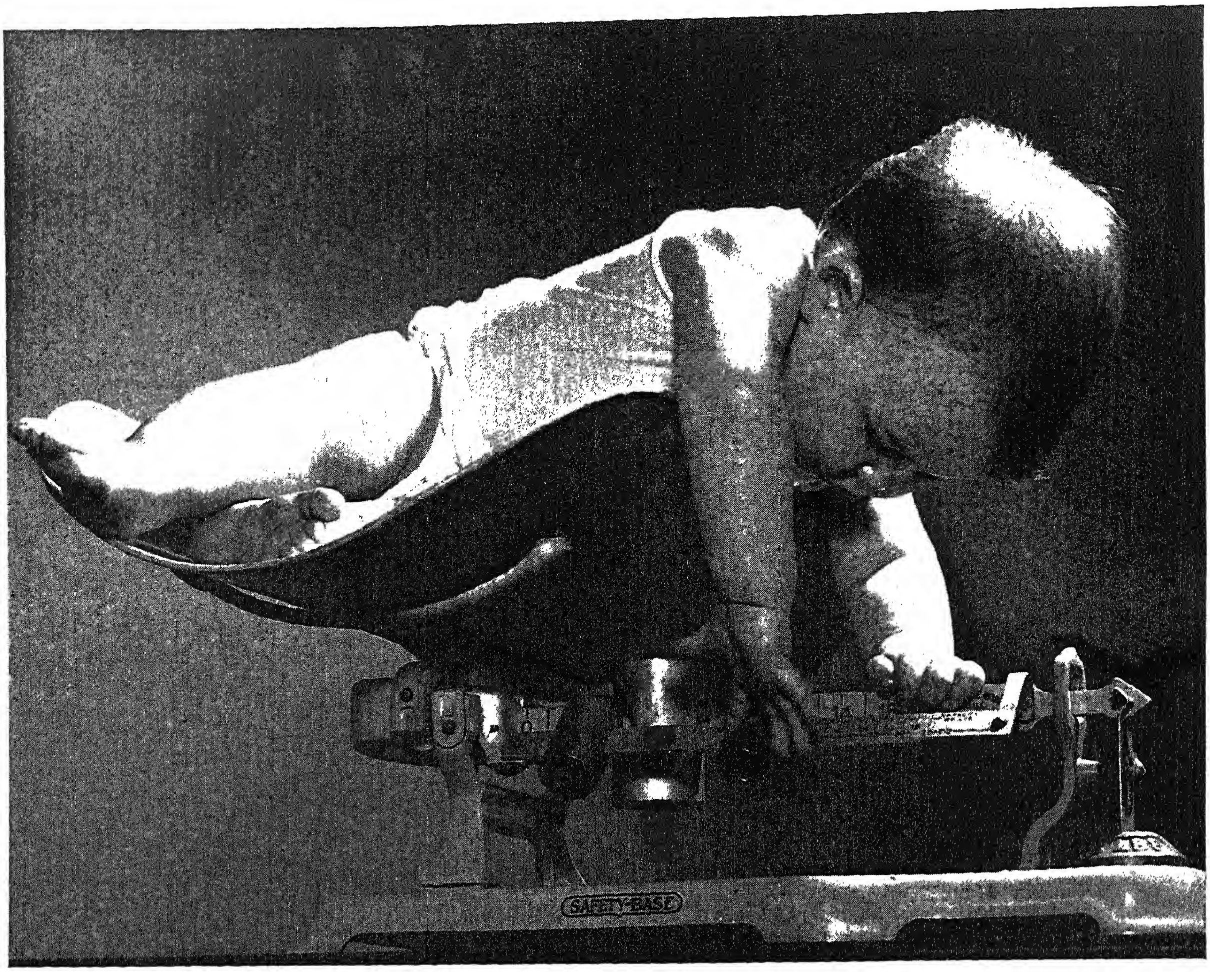
The field of application of the Super D Graflex equipped with the automatic diaphragm control and the built-in, open flash synchronizing circuit is extremely broad. Photography of pets and children as demonstrated by Korling's work is only a small part of it. Portraits, groups, theatrical and dance photography, closeups of hands, texture of skin, faces, fabrics and anything requiring accurate framing and composition, free from parallax and misalignment can be done so much better and easier with it. Commercial and illustrative photography, work with fashions and models, photography with Kodachrome is all simplified because the subject can be viewed on the ground glass so clearly up to the very moment of exposure.

To me these features are important not only because of what one can accomplish with them photographically—as they will definitely be held responsible for new qualities and a different character of photographs yet to be made in time to come—but because their introduction establishes valuable and highly significant design trends for modern cameras of the future.

Photography of Children

By Torkel Korling

"I don't see how you can have the patience," is the mother's usual expression after several hours of hard pursuit and stalking of her young child in obtaining photographs. Naturally it takes an abundance of patience but not the nervously upsetting kind which the mother seems to indicate. A fisherman can sit for hours



8. In following the daily routine of sleeping, dressing, eating, and playing, the photographer will find unlimited variety of interesting and pleasing photographic compositions of children. Often the most commonplace little happenings make the best and most exciting pictures.

waiting for a bite without becoming nervous or even too disappointed should he fail to get a nibble of response from the wary fish. In the case of the photographer it takes plenty of this kind of watchful waiting for a prolonged time, besides an abundant supply of film, to get successful pictures of children.

You wait constantly for favorable opportunities to catch good expressions on your subjects. These catches are sometimes far apart. While waiting for them you must be constantly and technically alert so that you can immediately coordinate your camera to the opportunity you have been waiting for. Just what you make out of this opportunity at this particular moment, plus your viewpoint and the sense of composition, is the final determining factor of your photographic ability in making pictures of children.

The most appealing pictures of children are invariably those that reveal no labored "creative" effort on the photographer's part. Children are natural only when they behave so and that is what you want in their pictures. Children are always at their best in their natural surroundings without any distracting influences from new or strange locations. In following their daily routine of sleeping, bathing, dressing, eating and playing, the photographer will find unlimited variety in interest and pleasing photographic compositions. After all, it takes a bit of simple observation to discover that the most commonplace little happenings invariably make

9. (*top right*) An example of a game spontaneously introduced by these two sisters. The younger one could not quite reach across the door opening. They did it over for me this once. It was lost when I tried to get an additional negative. Speed Graphic Photo.

(*lower right*) Children take a great delight in exploring new corners of the home. This picture gives just that delightful spontaneity of destruction.

DAVID COPPER-FIELD
by
CHARLES DICKENS

10. This can probably be called a blank staring expression but it is appealing in its helplessness.

11. Sleep overtakes this model. Speed Graphic, using daylight and one Photoflood.

the best and most exciting pictures. You are primarily after expressions in place of the commonplace stares and frightened looks which often creep into a child's picture if the photographer does not have the patience required.

The most salable baby picture, to an advertiser of any product at all, is perhaps a large head of a fair complexioned boy of six months to a year and a half. Perfection of features with curly ringlets of hair is not nearly as important as a funny little nose, a minus-one-tooth-smile, an unruly lock of hair and other little amusing characteristics that will give the picture a humorous appeal.

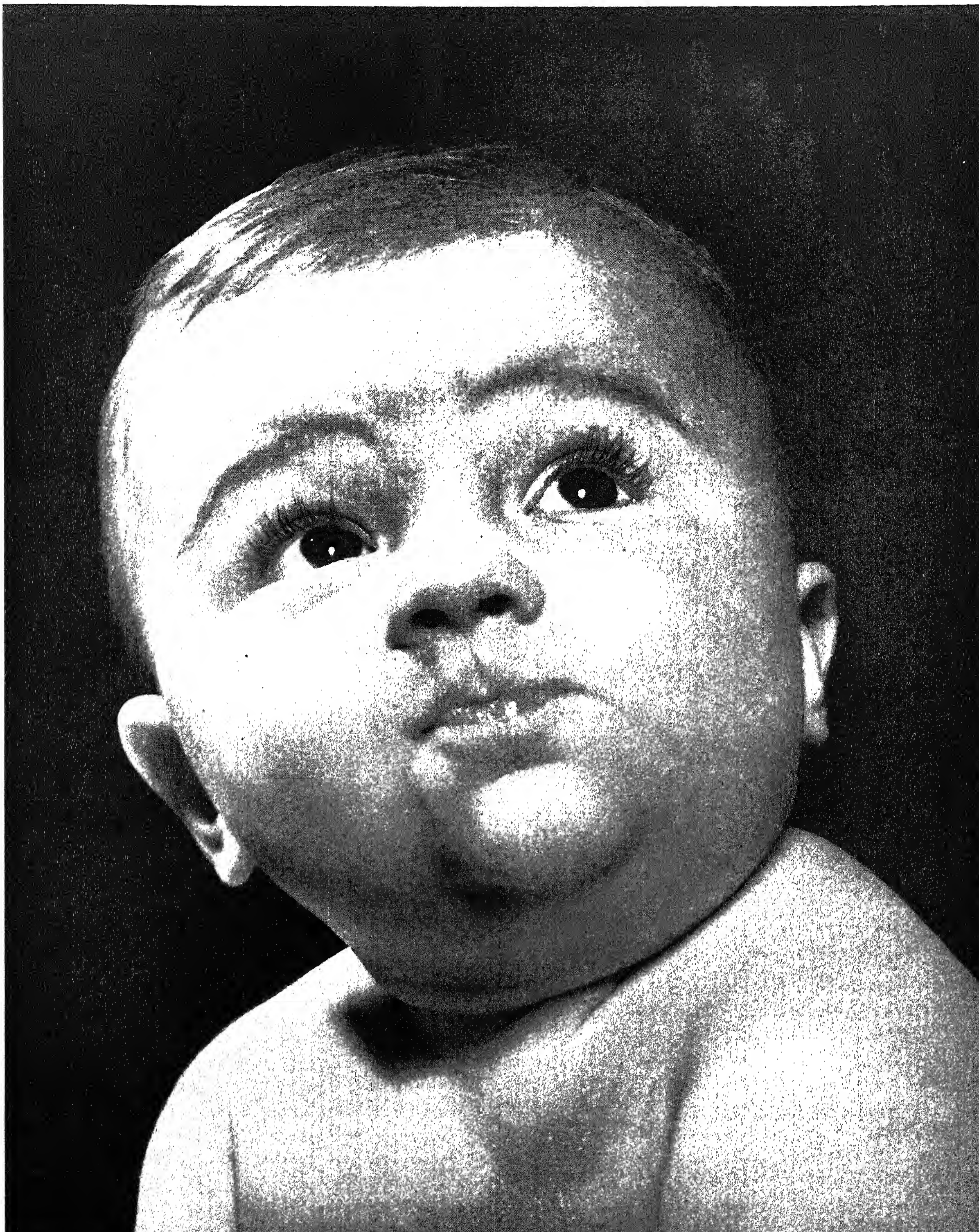
Getting Acquainted

When photographing a child you want him to look up, preferably toward a third person who should be present to assist whenever needed. You yourself have accumulated lots of intriguing photographic paraphernalia which will create plenty of inquisitive expressions on a child's face. A few of these expressions may be interesting but you will soon find out that every photograph will look alike if the child has the same wondering look as he sits spellbound staring at your shiny flashbulb synchronizer. This third person can be anyone who is familiar with the child and can command his confidence. However, you must help this assistant in influencing the child's behavior in any way which may tend to make a more pleasing photograph.

Before you even bring out your camera you should have cultivated your subject's acquaintance sufficiently to avoid having to overcome mistrust or timidity on his part. With most children you will have very little difficulty. There are many who insist on knowing you better before they will respond to you as they do to their parents. Children also have a good many off-days caused by various irregularities. With the very young ones the upsetting factor is usually teething. It is best to recognize these difficulties immediately and return when conditions are more favorable.

Watch For Expression Peaks

In working with children you will undoubtedly come to realize very soon that these youngsters are really much more intelligent than they are credited with being. Thus, any devices which stimulate their imagination. rather than their absorption in tricky toys, result in much better opportunities for real pictures. You will soon find that the childish expressions of joy, sorrow and interest may last long enough for time exposure but each reaction has a certain peak of expression of shortest duration. This expression peak is what you are waiting for and exercising all your patience to get. Just such interesting peaks are the ones you eagerly anticipate when you finally pull the negatives out from the hypo



12. The most salable baby picture, to an advertiser of any product at all, is perhaps the large head of a fair complexioned boy of six months to a year and a half. Perfection of features with curly ringlets of hair is not nearly as important as a funny little nose, a minus-one-tooth smile, an unruly lock of hair and other noticeable and humorous characteristics.

for examination. In fact a child's expression or reaction might easily be compared to the curve of a flashbulb. In this case there is a moment of contact or initial stimulus which takes a certain time lag duration before the build-up of the explosive peak of laughter, sorrow, wonderment and other emotions.

By learning to watch for these expression peaks the whole problem of child photography is greatly simplified. This same method is to be found where successful photographers watch for peak action in sports or during the photography of a dance. The Graflex Camera gives you an opportunity to follow this build-up of action right on the ground glass to the instant when the shutter is released.

I don't look for any typical pictures exactly. I take anything that comes along of sufficient interest. These can, of course, later be classified in various types but, from my viewpoint, the pictures are generally unpredictable unless they represent specifically assigned pictures to fit in advertising layouts.

Backgrounds should be as natural as you want the subjects to be. Their purpose is to fill the space that the subject does not need and suggest the situation. It should attract an indirect attention, and hence, be as inconspicuous as possible. Wallpapers of fancy designs are least suitable for backgrounds. In closeups the background generally goes out of focus. The tones and forms which result therefrom should be carefully studied so that they contrast rather than merge with the subject.

Children and babies are the most universally liked creatures in the world. Everyone has an opportunity to study their interesting and many times amusing actions. In fact, a whole household may revolve around the actions of a one-year-old youngster. By studying all these actions from a photographic viewpoint you will soon see many of these fleeting expressions and situations which must be photographed. The next step is to get your camera and actually make the exposures.

Camera Equipment

In my work I use a 4 x 5 Graflex. You can use the same type of camera or any other Graflex model because the actual technique is very much the same. It will be necessary for you to attach yourself so completely to the camera's focusing knob and shutter release that you may consider yourself as part of the camera. When the subject is confined to a play pen or high chair the focusing problem is naturally reduced to a minimum. You can focus with the lens diaphragm wide open and then stop it down for the exposure. Supplementary photofloods or synchronized flashbulbs can be used very successfully. In my own work I use the synchronizer extensively because this permits the use of small lens stops with the abundance of illumination.

The next problem is more complicated when the child is roaming around the room. Here you must patiently stalk along, watching for those favorable moments, probably even crawling on the floor at times and pushing the camera along ahead of you.

In order to focus with the lens wide open and quickly stop down the diaphragm at the instant of exposure, I have constructed a special release which connects with the diaphragm and the shutter. At the instant of pressing the shutter release a spring around the diaphragm of the lens is released and the diaphragm quickly closes to any prearranged stop, such as f:16 or f:32, just an instant before the shutter opens. The shutter is synchronized for flashbulbs. Such an outfit gives me an opportunity to fully observe any subject on the ground glass, and at the same time, permits instant operation when an interesting expression or pose is assumed by the child. As the best results in focusing and depth of focus are, unfortunately, at the opposite ends of the diaphragm scale, it is essential that the focusing with the lens wide open be as closely coordinated with the final stopped down lens as possible. I have solved this by means of my special diaphragm synchronizer.

Synchroflash Pictures

It is common knowledge that the high speed lens of the larger size camera gives you shallow depth of focus at a large aperture. To obtain sharpness and definition a reduction of the diaphragm is required. As you reduce the opening of the diaphragm in the lens, the light which can pass through the lens is proportionately decreased and this calls for a longer exposure. The flashbulb solves this problem as it has both speed and volume of light. With flashbulbs you can use even the smallest lens apertures and secure the extreme depth of sharpness. At this small diaphragm setting you are now at the opposite end of the diaphragm scale for focusing and taking of the picture. In this position speedy operation of the camera is most essential. You cannot very well reach out with your hand and stop the lens down and then set off the flashbulb. This is where the efficient working synchronizer comes to your assistance.

The use of one or more flashbulbs on the Graflex or even the Speed Graphic Camera will give you a freer range for all your photographic work of children. It will not be necessary to have light wires trailing to large reflectors when you can have your assistant hold one of the flashbulb reflectors while the other is mounted on a bracket attached to a camera. In this way you carry your light with you when following the child, who soon becomes accustomed to your presence and goes about his own natural play and expressions.

The whole problem of lighting should not be made as

complicated as the average studio set-up where one finds lots of equipment and many assistants. In fact with the two light sources already mentioned you can obtain a third dimension effect which surpasses almost any other type of lighting for children's pictures. There is no time to study lighting while you are trying to get pictures unless you expect your subject to remain in one idle position for minutes at a time. All such experimentation should be done beforehand and thoroughly impressed in one's mind because it is impossible to move around photofloods and flashbulbs for special effects when you are actually on the job.

In my work I use two 10-inch aluminum reflectors. One of these should be mounted on the camera about 20 inches above the lens and covered with two or three thicknesses of tracing paper, or possibly in some cases a linen handkerchief over the bulb will give the proper diffusion. This type of light on the camera serves to give a softer illumination in the shadows. The other reflector without any diffusion screen is placed away from the camera in positions for directing the strongest illumination. In fact this second light really serves as a spot light and the softer camera light serves to illuminate otherwise harsh dark shadows which would have been cast if only one side light were used. This is the simplest and most effective lighting formula for quick work. The light sources will not contradict each other because the actual highlights and shadows are being produced from the one strong light source only.

Daylight Photography

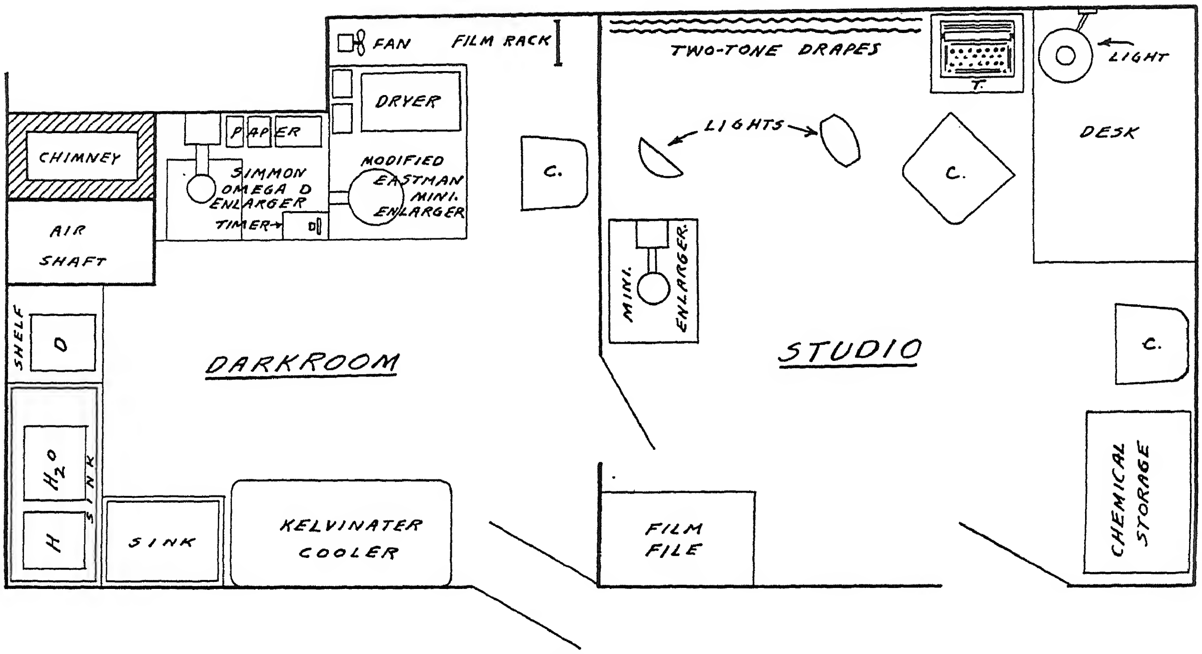
Out of doors the lighting problem may seem an easy one. You probably wouldn't even try to make outdoor pictures unless the weather permitted. The sort of weather that permits the best result is a slightly overcast sky in which the sun shows through sufficiently to brighten up the highlights. A condition like this may be ideal but it also is rare and any sunny day will have to do.

The old amateur rule of letting the sun come from over the photographer's shoulder will let you get away with a minimum of exposure, but what you are exposing for will take on a rather miserable expression. Before sunshades were considered a most important accessory this rule eliminated halation and coma, troubles caused by the sun shining in through or on the objective. Put a lens shade on your lens, then reverse the rule to protect your subject's eyes and get a brilliant lighting.

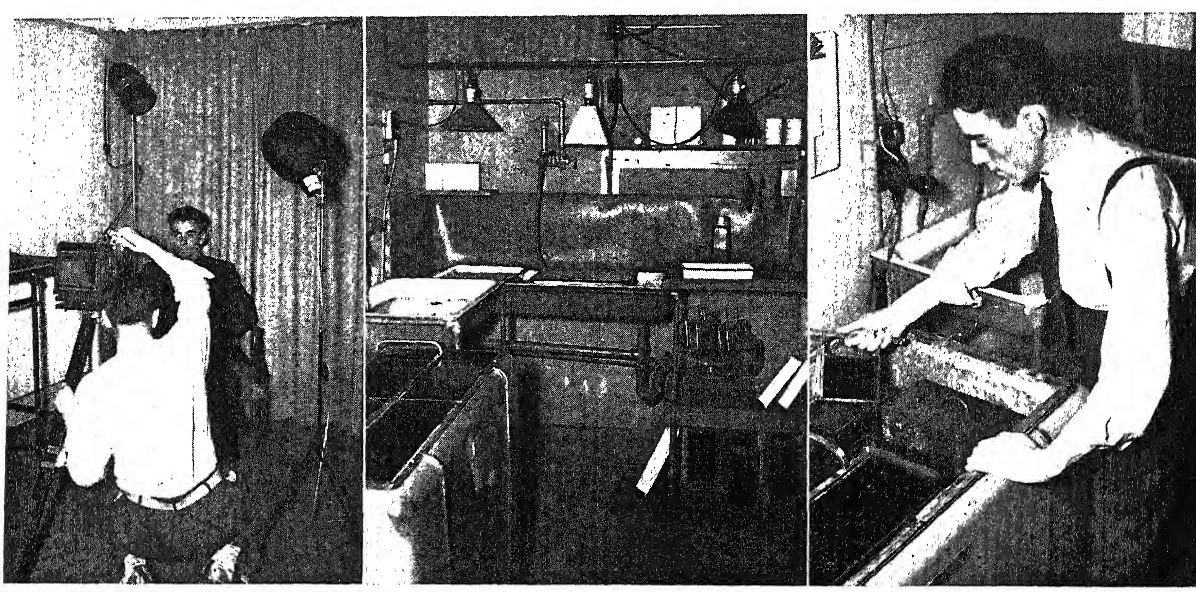
A good rule that cannot be changed is to expose for details in shadows. As the face now is in the shadow, the exposure must be increased considerably, perhaps double or more. This lighting is really rather contrasty, but, by keeping the negatives very soft, it is not necessary to use reflectors or mirrors which may result in better quality but a quality of the studio rather than the natural out of doors.

If you get up early enough, the light is excellent right after sunrise and it is just as good shortly before sunset. At those times no strained expression will result even if your subject looks straight into the sun.

Good photography of children and their pets really comes down to just simple straightforward photographic practice. You need a good camera with the accompanying lighting equipment for making exposures which have fine detail. The next step is in knowing just when to push the trigger while watching for those appealing expressions. And the final step is in developing and printing the picture. Once you have your camera technique in hand your main emphasis should be on the careful and patient selective watching of the childish actions of subjects.



1. FLOOR PLAN OF DARKROOM AT THE ELMIRA, N. Y. STAR-GAZETTE. This darkroom serves the three Elmira Gannett newspapers according to Wells Crandall, Chief Photographer, who prepared the above plan.



2. *(left)* A corner in the Elmira Star-Gazette studio showing setup for making the usual newspaper interior pictures. Here the Speed Graphic is used on a tripod. Exposure is usually 1/25 second at f:5.6 using Fast Pan film. Back drops are of a light brown and deep maroon monk's cloth for contrast rendering. A No. 4 Photoflood used for general illumination is not shown.

3. *(middle)* The processing end of the darkroom. Kelvinator beverage cooler is used to maintain a constant temperature for all developing, washing, and fixing solutions.

4. *(right)* Photographer Charles Romas removes a batch of films from the hypo tank in the special cooler. Above photos from Wells Crandall, Chief Photographer, Elmira Star-Gazette.

THE PHOTOGRAPHIC DARKROOM

HENRY M. LESTER

When we have access to running water and electric current supply — we actually have the essentials of a photographic laboratory. Other things, of course, are necessary, but they are just . . . so many accessories! Without these two prerequisites, neither the amateur, anxious to develop his negatives in the kitchen or bathroom, nor the photographer with facilities of an elaborate plant of a news-gathering organization, can accomplish very much. Their ultimate aims are alike: each is eager to transform an unstable, "dormant" picture, which, they hope, *is* on their film, into a finished print through a series of procedures essentially similar. But, because their specific problems are different, their methods, facilities and equipment are not, and cannot be, alike.

The amateur may be upset because he is unable to get into the kitchen or bathroom of an evening, but the news photographer is facing a calamity if anything will prevent him from seeing his finished prints within fifteen or thirty minutes after he "blows in" from his assignment. These are, obviously, extremes. The darkroom problems of the majority of the photographic fraternity fit in somewhere between these two situations. Most of them are willing and able to put up with all sorts of inconveniences and privations, and still manage to come through with creditable prints. Comparatively few photographers can boast of comfortable or luxurious working quarters. The reason for this is not so much the cost of providing them, as the fact that few darkrooms, professional or amateur, are an outgrowth of planning. Most of them have been born suddenly, when their owner decided to "do" photography — and have since grown and outgrown their physical limitations.

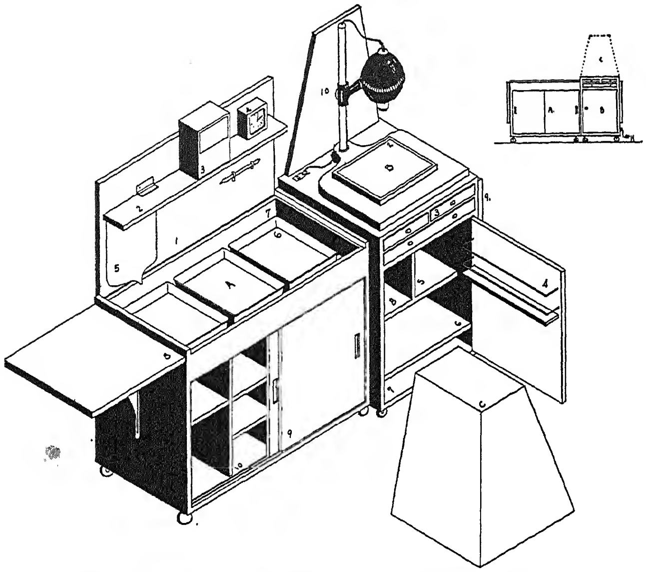
What a Darkroom Needs

In addition to an adequate supply of running water and availability of electric current, the darkroom requires adequate circulation of air and means of excluding light. A darkroom need not be dark or dingy; on the contrary it should be as bright, cheerful, clean as any other space where one may not only spend many hours, but invite one's friends as well. This, of course, presupposes the availability of a separate room or enclosed space in a home.

Photographic laboratories can best be classified as a *personal darkroom*, intended for use by one or two people, and a *commercial darkroom*, intended for a "production line." It is quite impossible to draw a line between these two, but they delineate best the physical and structural aspects of the problem. Thus a *personal* darkroom may be that of an amateur, professional, commercial or free-lance worker, while by *commercial* is meant a large laboratory with facilities available for all types of work requiring much mechanical equipment, and the efforts of several people.

The most primitive type of a photographic darkroom is, of necessity, the makeshift version of it; that of an apartment dweller. Space being at a premium, people living in apartments can rarely enjoy the luxury of a separate space for their photographic work. They must confine their efforts to kitchens, bathrooms, closets, or dressing rooms. Everything they own, photographically speaking, must be of portable and collapsible type, which can be easily stored away when not in use. Apartment dwellers' equipment usually consists of a daylight loading development tank for their films, a small safelight, some developing trays, glass graduates, thermometer, timer, small enlarger, small trimmer, and a couple of blotter rolls for drying prints. A photographer who cannot afford a separate room or space should own a utility cabinet where his equipment and supplies, especially chemicals, will remain out of harm's way, and not accessible to uninitiated and junior members of the household. These people will do best if they use prepared chemicals available in powder form ready to dissolve in water without the necessity of weighing or measuring them. This will save them much time, money and space.

For those who can afford it, an interesting solution of their apartment house portable darkroom is offered herewith in the form of a "photo-wagonette," a unit designed by Richard Carver Wood, architect and photographer. This design offers a very practical and complete solution in that it has everything in a compact unit. When not in use, the three units of which this photo-wagonette consists form an attractive piece of furniture, 4 feet 6 inches in length and 18 inches deep. Its height depends upon the type of enlarger available,



5. PHOTO-WAGONETTE. As photography creeps into the small apartments there is a constant demand for darkroom space. This "Photo-Wagonette" is one of the solutions for the apartment facilities. See description below for details. Designed by Richard C. Wood, architect. Copyright Condé Nast Publications.

which remains concealed when the convenient stool "C" is placed over it as a cover. The unit is conveniently wheeled into the kitchen or bathroom, plugged into the electrical outlet, and is ready for immediate operation.

Description of Photo-wagonette

A) Developing unit, B) Printing unit, and C) Cover for the enlarger (also used as a stool). *In the developing unit*: 1. Top of cabinet which lifts up to form shelves. 2. Shelf hinges down to hold 3, safelight; 4, timer, etc. 5. Viewing plate. 6. Space for three trays. 7. Acid proof trough which can be removed for cleaning. 8. Work table. 9. Sliding doors. 10. Shelves for storing chemicals, etc. 11. Extension cord.

In the printing unit: 1. Enlarger. 2. Easel or paper holder. 3. Light proof drawer for printing paper. 4. Printing paper storage. 5. Equipment storage. 6. Film storage. 7. Paper cutter space. 8. Space for timer, safelight, etc. 9. Lowered shelf. 10. Part of unit C which remains in place. Unit C is the cover for the enlarger; also used as a stool.

Darkroom in a House

The photographic laboratory either for a new house or to be installed as an alteration of a space of approximately 10 x 14 feet in an existing home represents a very complete solution to the problem. It would not have to be as complete, or as elaborate as the one shown herewith. The usefulness of this arrangement, planned by Henry M. Lester and designed by Richard Carver Wood, lies in the fact that its individual features may be eliminated to fit the personal requirements or pocketbook of the owner. Thus, for instance, while a revolving door is ideal for the entry of a darkroom, it can be substituted by another variant of a light-tight closure. Here are the specifications for this darkroom:

Explanation of Darkroom Plan

The drawing on page 347 shows the floor plan of a 10 x 14 foot darkroom. Detailed elevations of the north and east walls appear above and to the right of the floor plan. Equipment is identified as follows: 1. Revolving door, light proof and dust proof. Made of plywood. 2. Control switches for general illumination and for special circuit of convenience outlets. Also for special ceiling light fixtures each containing a safety light and a white light. Each of these lights is separately controlled. 3. Closet for storage of equipment. 4. Light boxes in ceiling as described (2). 5. Paper cutter. 6. File drawers for negatives. 7. Shelves. 8. Narrow shelves for printing paper. 9. Dry work table. 10. Contact printer built into work table. May be tilted for retouching, etc. Materials for retouching in drawer below. 11. Shelf for timing clocks, metronome, dodging accessories, air thermometer. 12. Enlarger. 13. Light proof drawers for printing paper of different sizes. 14. Ferrotype tin rack for drying glossy prints. 15. Shelf for drying and storing trays. 17. Shelves for mixing solutions, bottles, etc. 18. Foot switch for enlarger. 19. Trays in shallow trough of sink (22) which drains into deep sink (23). Hinged cover (21) goes over this trough when not in use. 20. Storage space for stock solutions. 23a. Towel rack. 24. Wash tray for prints with siphon (25). 26. Faucets, at least three cold and one hot, mixing type. 27. Cabinet for storage of dry chemicals and scales. 28. Cabinet below work table. 29. Linoleum-top work bench which may slope towards deep sink for draining. 30. Hinged book-type racks for drying prints between stretched muslin. 30a. Rods for suspension of films for drying. 31. Storage shelves. 32. Utility shelf for mounting equipment. 33. Desk top for record-keeping, etc., and work top for mounting and spotting prints. 34. Drawers for records, etc. 35. Finished print file. 36. Dry mounting press. 37. Window, properly light proofed. 38. Light proof screen. 39. Ventilation intake, electric blower. Brings fresh air from outdoors through (40) in milder weather, indoor air from (41) in cold weather. 42. Hang-up type telephone set. 43. Small radio completes this darkroom.

No matter how big or how small your darkroom will be, it should be laid out in accordance with the following basic principles:

1. The production line should be in a certain direction to avoid retracing of steps. The direction of the line will be determined primarily by the location of the water supply and waste lines. Whether it will run from left to right, or from right to left, it should be consistent.

2. All electric wiring should be properly installed, preferably by a licensed electrician, but, if done by the photographer himself, the wiring should meet the prescribed standards of Underwriters Laboratories. Plenty of electric outlets should be available, but not of the

cheap ten-cent-store-variety, since they burn out easily, do not hold plugs firmly. A plug which may fall out of its socket during an operation requiring total absence of light will "arc," producing both a fire hazard and a source of fogging of film or paper.

3. Assure complete light-tightness of the darkroom by providing light traps at points of entry and exit of air.

4. Make windows and doors light tight, but do not exclude air. This is very essential, when handling modern super-speed films. When the darkroom is made thoroughly light tight, it need not be painted black. Only wall areas directly adjoining sink or tables should be painted black. Good acid proof paint such as Kodacoat is recommended for this purpose. Ceiling should be white and walls either white or covered with a special Panchromatic Green paint, also produced by Kodak for this express purpose. The Panchromatic Green paint improves visibility in the darkroom when green safelights are used.

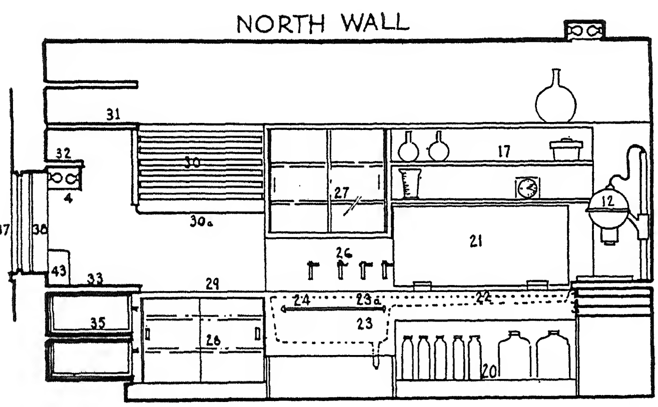
5. Water should be available from more than one tap. If installation of an extra water tap is impractical, water coming from a single tap can be divided into two or more channels by means of suitable rubber hose, and proper "V" connectors.

6. The sink should be of generous proportions and equipped with wooden slats which will reduce splashing and prevent breakage of glass and composition utensils.

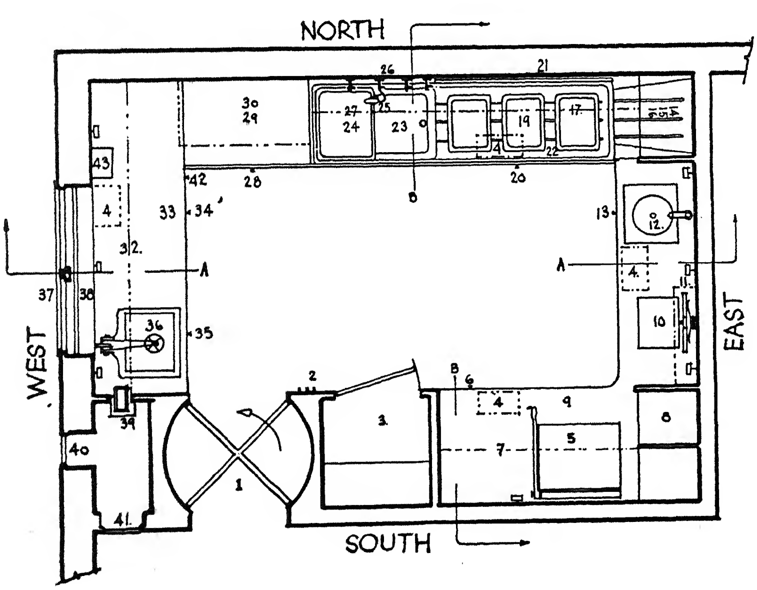
7. Ample shelving should be provided above working benches, and plenty of shelf and closet area should be provided under them. Convenient racks for developing trays and other utensils will be found to help maintain order at all times in the darkroom.

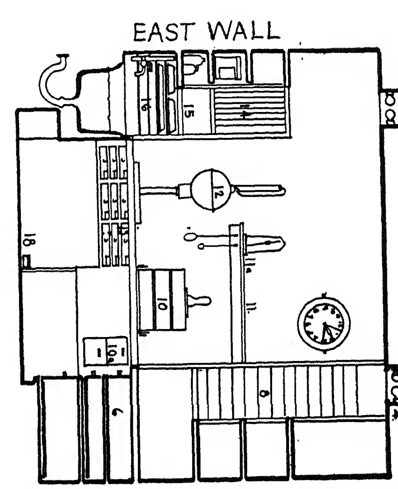
8. All dry chemicals should be kept locked in a closet or converted cupboard. Solutions should be stored in wide-mouth bottles with bakelite, screw-on tops.

9. Absolute cleanliness should be maintained in the photographic laboratory, especially when it is of a single room type. All powder chemicals and dust cause tiny



6. A MODEL DARKROOM designed to cover floor space 10 x 14 feet. The elevation of the north wall is shown at the left, while the east wall elevation is shown below. Complete details referring to each figure number in the drawings will be found in the right-hand column on Page 346. Planned by Henry M. Lester, designed by Richard C. Wood for House & Garden. Copyright Condé Nast Publications.





7. A MODEL CHEMICAL CABINET. An attractive looking chemical cabinet is something which every photographer should be proud of. This cabinet is in the darkroom of Arthur W. Grumbine. Note the advantages of having chemicals conveniently arranged for instant use.

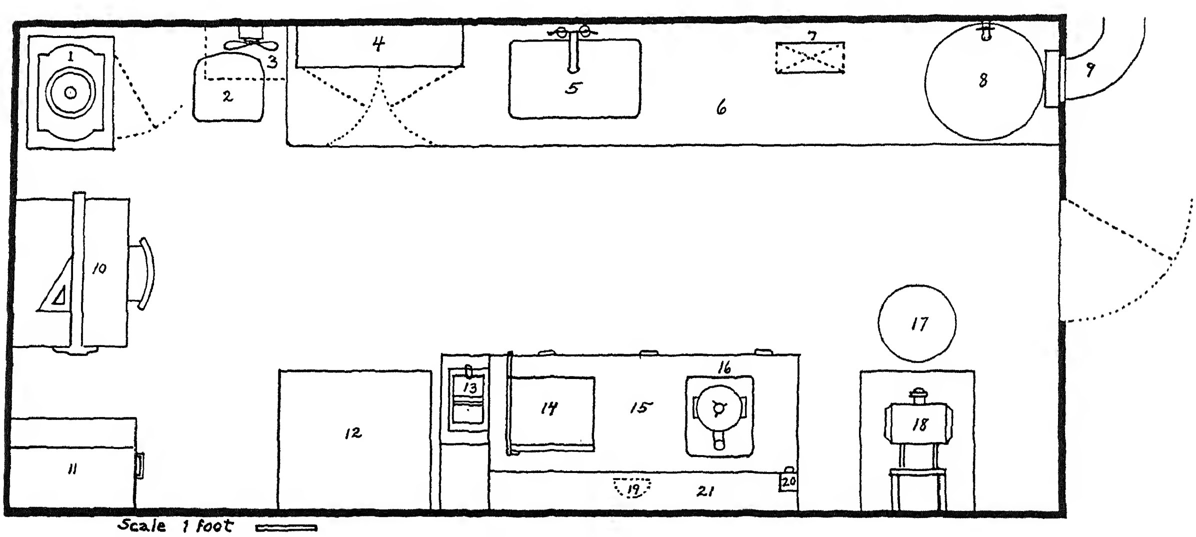
particles to float in the air. Some of them may cause stains or specks on photographic materials and finished work. It is best therefore to avoid mixing and handling of dry chemicals in a small darkroom, unless sufficient time can be allowed for the dust to settle. After that the floor and work benches can be cleaned off with a damp mop or rag.

10. Once a space has been provided for a given item, it should remain there permanently. This will enable the photographer to locate things in his darkroom even in complete darkness. It is surprising how often a critical situation may arise while loading or unloading films and how important it may be to lay your hands on, say scissors, screw driver, or paper clip.

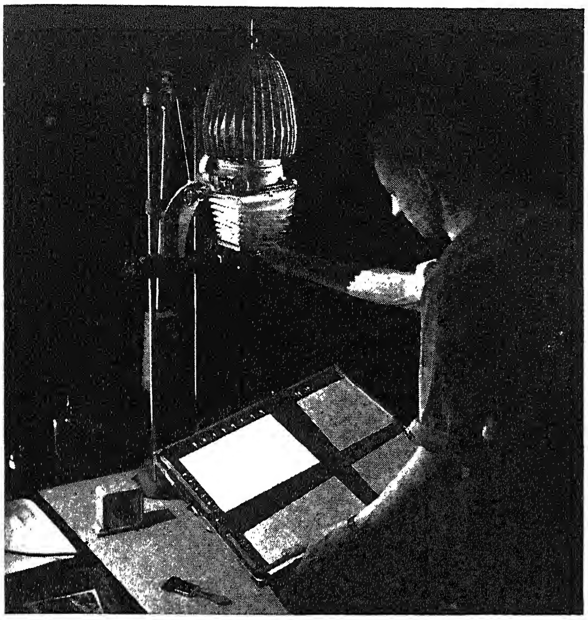
The accompanying illustration, Figure 7, shows Arthur W. Grumbine's very efficient looking chemical cabinet. Other illustrations in this chapter will provide additional ideas about convenient storage space easily provided at very reasonable costs. Commonly used formulas should be kept handy. A copy of the PHOTO-LAB-INDEX will provide a complete formulary and details of all photographic procedures. Formulas frequently used, and some Time-Gamma-Temperature Charts may be conveniently copied, enlarged, and tacked onto the wall, or better still, to a special cork bulletin board where they can be seen at all times.

Equipment for Printing and Enlarging

In selecting the apparatus for printing and enlarging, one should be guided by one's pocketbook, and consider size of negatives, prints and darkroom dimensions. One should select always the best buy in photographic



8. This floor plan shows the complete layout of Arthur W. Grumbine's own darkroom: 1) Cabinet for holding trays, ferrotype tins, blotter rolls, and letter press on top of cabinet, 2) Chair, 3) Exhaust fan at ceiling, 4) Chemical cabinet, 5) Sink with hot and cold water and mixing faucet, 6) Long work bench, 7) Adjustable ceiling safe light, 8) Print washer, 9) Fresh air entrance through cellar window, 10) Drawing table and chair, 11) Large steel filing cabinet and book case, 12) Small table for loading film, mounting, etc., 13) Contact printer, 14) Print trimmer, 15) Work table with drawers for paper, etc., 16) Small negative enlarger, 17) Stool, 18) Large negative enlarger, 19) Safe light, 20) Rheostat to control illumination in enlargers, 21) Shelf.



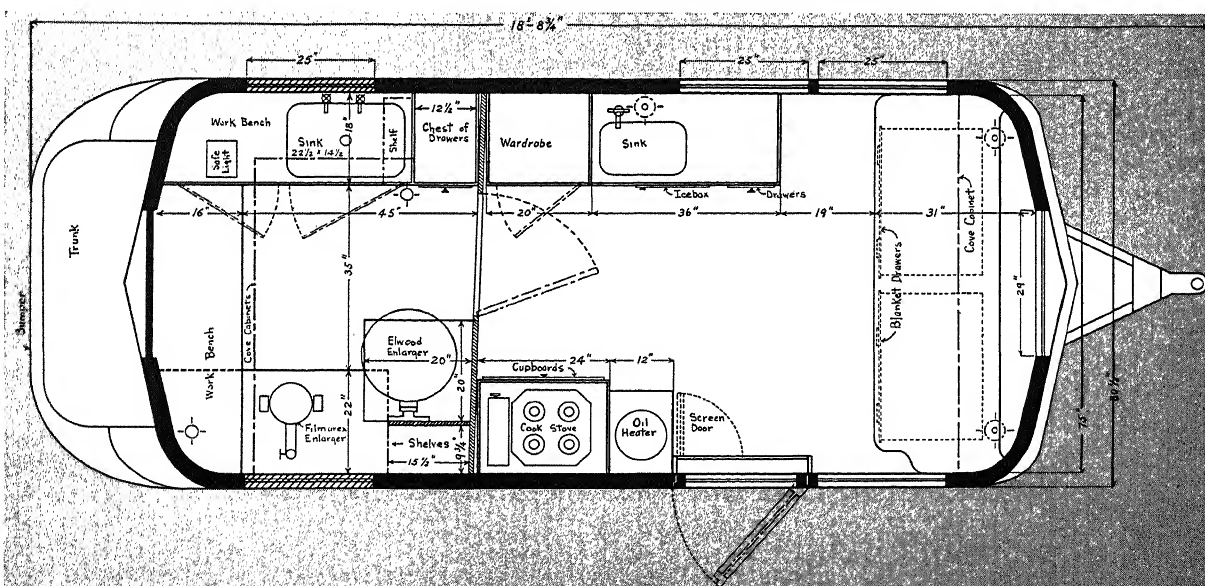
9. THE GRAFLEX VARIOGRAPH ENLARGER provides a most efficient piece of darkroom equipment. With its broad range of reproduction ratios: from 0.25x to 18.2x —it accepts negatives ranging in size from 24 x 36mm (35mm and Bantam) up to 2¼ x 3¼ inches and 6.5 x 9cm. The enlarger is shown here in use with the paper holder supported by the accessory Variograph Easel Holder. The entire unit is fully described on p. 352.

equipment and acquire equipment which can be used for as many purposes as possible, to save money and darkroom space. Thus for instance, an enlarger can be used for both enlarging and contact printing, with the aid of a simple contact printing frame. On the other hand, some people may prefer to have an enlarger and a special contact printer. An efficient enlarger, combining the most desirable features of modern enlarging equipment is provided by the Graflex Variograph Enlarger. (Fig. 9) Its many well designed accessories render it available for a variety of purposes, as copying, macrophotography, photomicrography, color separation work etc.

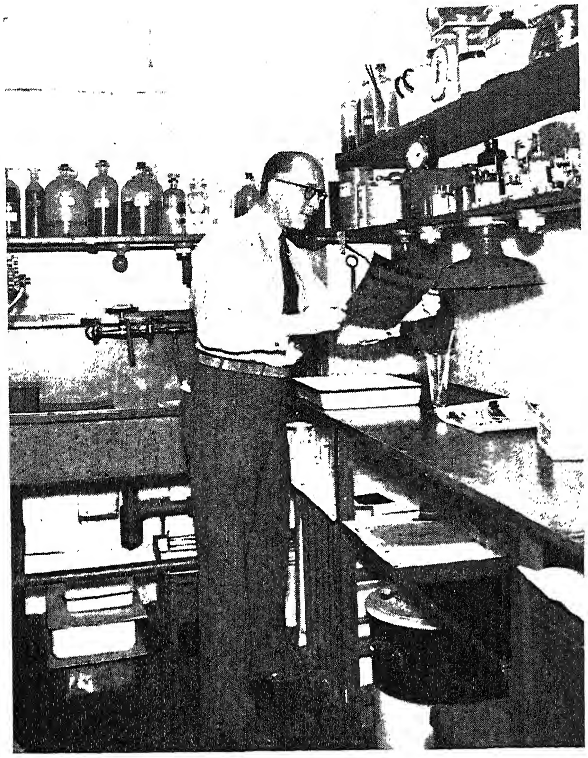
In addition to the enlarging and printing equipment, the following supplies and utensils should be considered as essential in the darkroom:

Sets of three 5 x 7, 8 x 10, or 11 x 14 developing trays; a timer clock or special interval timer, or both; good chemical scales. Print washer or a large tray with automatic syphoning device; blotter rolls or special print drying cabinet; ferrotype tins, preferably chromium plated for making of glossy prints; a good paper trimmer; dry-mounting equipment; ample supply of good quality small accessories; film clips, print tongs, measuring graduates and beakers, funnels, hand roller, squeegee, viscose sponge or an ample supply of cotton.

For those who prefer development of negatives by the Time-Temperature method, a small developing tank for cut films and film packs is recommended. However for larger size negatives, it will be found more practical to use open



10. THE TRAILER DARKROOM. This floor plan shows the traveling darkroom designed by William G. Houck, Jr. The complete story on this darkroom appeared in the October 1939 issue of *U. S. Camera Magazine*. When temperatures are low, a 9-ampere electric heater brings the room to the desired temperature. During hot weather the solutions are iced and the trays floated in either cool water or running tap water. Most processing is done during the night or early morning after solutions have had a chance to cool.



11. This photograph shows Harry A. Scheer in his own darkroom. A photographic darkroom is one place where every photographer can express his own individuality. No two darkrooms are ever alike.

deep tanks in connection with developing film hangers. Ample supply of these should be available, and they should be kept clean.

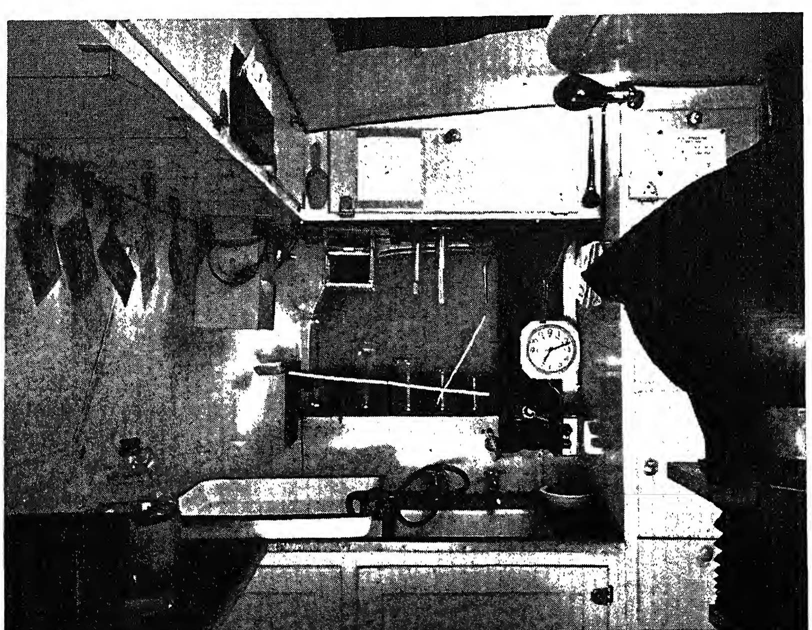
Film drying facilities should be given serious consideration. The simple home clothes dryer provided with wood spring clips, suspended from the ceiling, makes an ideal dryer for cut films and film packs. With it either the film clips or developing film hangers can be used. Its advantage consists of being able to lower it for hanging films, and raising it out of the way for subsequent drying.

Budgeting the Darkroom

If a darkroom is equipped gradually it usually is more complete at the end of a given period than if everything is acquired at one time. A large single outlay makes acquisition of good equipment difficult. One is lead to economize on individual pieces of equipment. Furthermore one's photographic requirements change in time, and it is possible to find that a piece of equipment acquired earlier is not suited for certain purposes which develop as the photographer modifies his technique or interest.

The Press Darkroom

One of the most important divisions of the newspaper is the photographic department. Here is where the routine pictures as well as the quickest scoop photographs are produced for daily use in the paper. In addition to an efficient photographic staff of operators there must also be an efficient processing department. Right here is where the importance of layouts must be taken into consideration for the convenience of the workers. Where more than one photographer might be working in the



12. TRAILER DARKROOM showing the sink side. Large negative enlarger at the right, with work table at the left. A shelf over the sink with partitions holds glass graduates and prevents damage. The bottles of solution are fitted together in cupboards with sections of inner tube around them to avoid breakage.

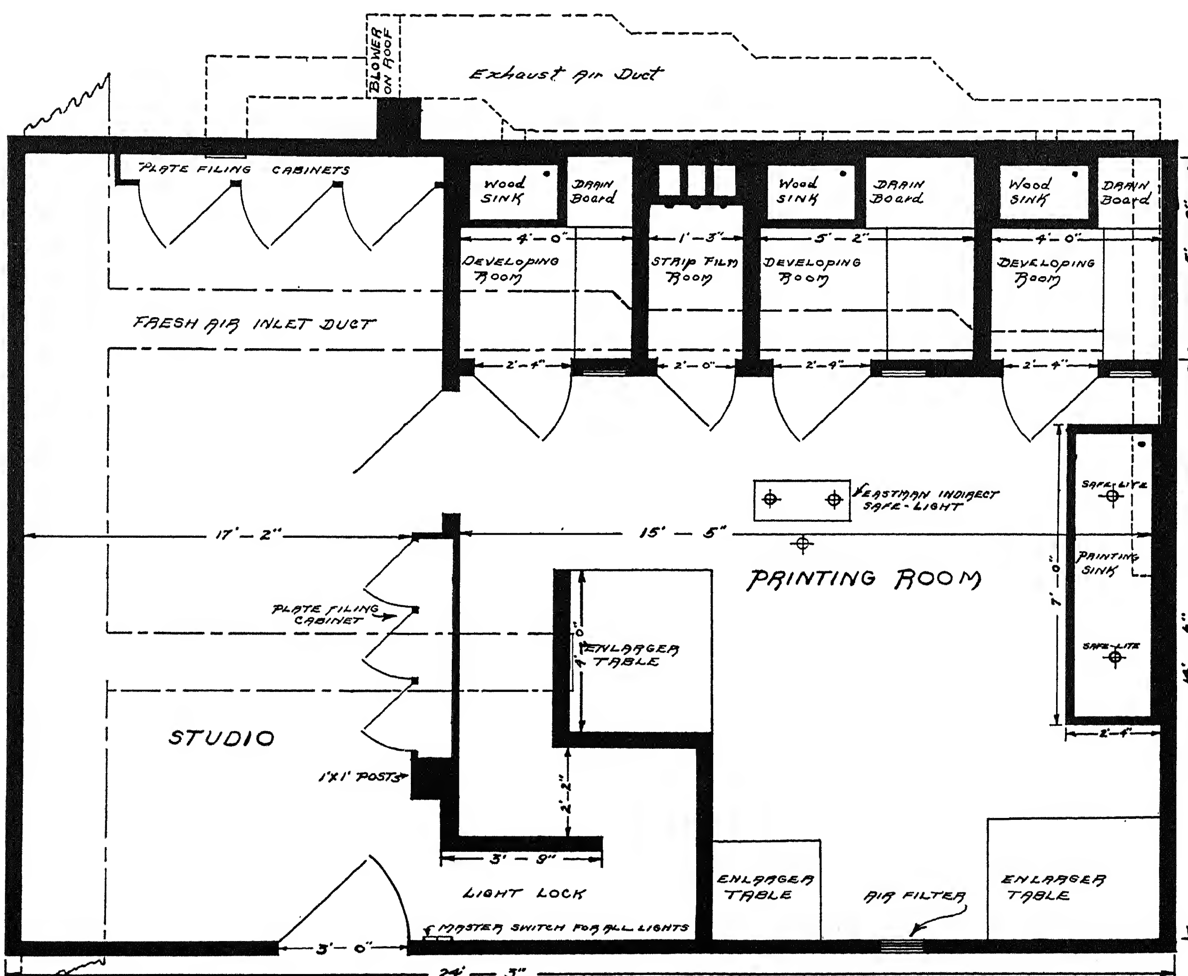
darkroom at the same time there must be provision for the developing and printing of pictures without any slow-up or interference.

We have seen many newspaper darkrooms which were located back among the partitions and steam pipes. In other words, they were given the only place left after the elaborate engraving department, press division, and other operating units of the newspaper claimed their space. As an efficient darkroom is just as important as the streamlined engraving plant it is very necessary to give this processing department more careful attention.

The importance of speedy processing is taken for granted in practically every press darkroom. Competing newspapers force the photographer to get his films developed and printed in the shortest possible time. Usually the evening newspapers step up this speed factor. There are deadlines to be met and the paper must go on the street on schedule. In fact, all of the departments of a newspaper are subject to this speedup with the approaching deadline. The photographer swings into this cycle with the keenest sense of competition and co-operation within his own plant.

Possibly the four most important factors to consider are a) plenty of convenience working space, b) efficient layout of the equipment and processing rooms, c) good modern darkroom equipment, d) finally, every human being must have fresh air.

On the newspapers where there are several photographers, the ideal way is to have two or three small individual darkrooms which open into the central work room. In this way each photographer can do as complete work as possible in his own small room. Of course, this means that there must be an enlarger and other equipment in each room. This extra cost factor must be con-



13. DARKROOM FLOOR PLAN AT THE "DEMOCRAT & CHRONICLE," ROCHESTER, N. Y. This floor plan was designed by A. S. Best, submitted by Ralph Amdursky for publication in this book. This floor plan illustrates one of the convenient arrangements for the average press darkroom as described in the text above.

sidered. In case the individual rooms can not be completely equipped, they should have all the facilities for individual developing and the communal work room will be a place where the enlarging and printing work is carried out.

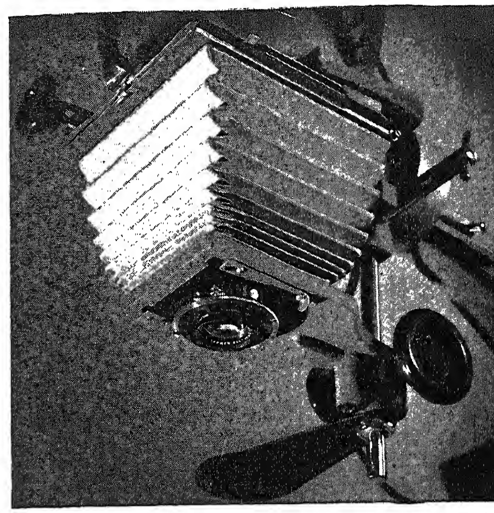
In this central work room it is possible for one man to take care of the print developing with two other photographers working on the enlargers. This helps to speed up the work and produce the finished prints in record time. This method also provides for individual supervision over the prints being produced by each one of the photographers.

The importance of good equipment can not be stressed too much. This usually calls for a well-made miniature enlarger, a medium size enlarger to take the larger films up to 4 x 5 inches in size, and finally a large 5 x 7 or in some cases an 8 x 10 inch enlarger for the big negatives produced by the 5 x 7 Graflex and Big Bertha cameras, in addition to any of the large View Camera negatives. This equipment must be kept clean and free of dust at all times. Dust-proof enlarger covers will help prevent a lot of dust troubles when the equipment is not in use.

Every darkroom should have good clean fresh air at all times. Ample ventilation can be secured by using air conditioners, fans, and special ventilators which are available. For example, the 10 inch fans which are used in the students' darkrooms at the Rochester Mechanics Institute bring in 250 cubic feet of air a minute. These darkrooms are 6 x 8 feet in size.

Graflex Variograph Enlarger

A good enlarger, well designed and accurately made is an important prerequisite for enlarged photographic prints of good quality. It is just as important as a good camera, both being merely links at the ends of a chain of steps leading from the making of a photograph to the production of a finished print. The Graflex Variograph Enlarger represents a well-designed unit incorporating many practical features of great appeal to advanced photographic workers. A condenser-type enlarger, it is equipped for use with interchangeable lenses, mounted on lens boards of the Miniature Speed Graphic size. Intended for the enlargement of negatives of the smaller size, it is well suited for this type of work, which requires precision equipment for most satisfactory results. The enlarger will accept negatives (films or plates) ranging in size from 6.5 x 9cm and 2¼ x 3¼ inches down to the 24 x 36mm (35mm and Bantam films). It offers a range of reproduction ratios from 0.25x to 18.2x on its baseboard, and considerably beyond that when images are projected onto the floor or upon a wall. Its efficiently cooled lamp house is designed for use with a standard G.E. No. 211 (75W-110V) enlarging lamp. The enlarger (Fig. 9) head is rigidly supported by a three-legged column which rests securely upon a substantial baseboard of generous proportions: 24 x 32 inches. The column can be revolved around its vertical axis and can

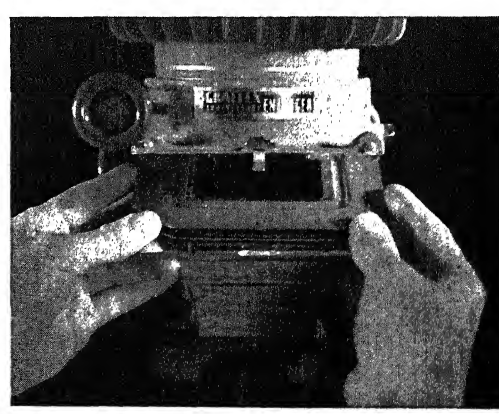


14. The bellows, slide-locks, lens-board, focusing controls, and filter.

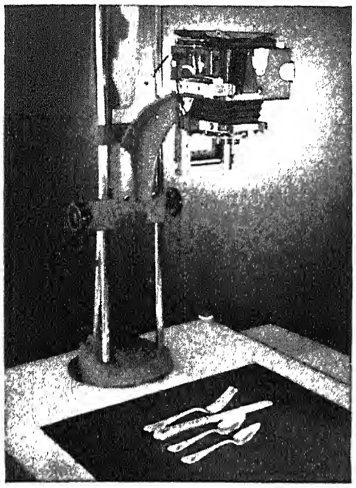
be fixed in any position. The lowering and raising of the enlarger head is easily accomplished through an efficient system of counterbalancing. A micrometer control wheel permits adjustments to be made with extreme accuracy, and a locking wheel holds the head securely in any position. Accurate focusing is accomplished by means of micrometer controls which activate camera-type bellows connecting the lensboard with the negative carrier (Fig. 14). The latter are of the book-type, of a novel construction known as the "combination glass-and-glassless." This type of negative carrier may be used with or without glass and either one or both of the glass plates can be used, a feature which will be appreciated by photographic workers who have occasion to enlarge from wet negatives.

What Is Variography

One of the most advanced and desirable features of the enlarger is that which earned for it the properly



15. The platens and Variograph control-wheels.



16. As a camera stand.

coined term: *Variograph.* The expression stands for the ability of the enlarger to alter the linear perspective of a photograph. This is sometimes necessary as a corrective measure for changing excessively converging lines in a picture, and sometimes as an intentional alteration prompted by the desire to introduce more rapidly receding perspective in a picture where such arrangement would make it more pleasing. Linear perspective had always been altered by the simple expedient of tilting the paper easel. This usually required work with fully stopped down lens aperture, to produce the maximum zone of sharp focus (depth of focus). The Graflex Variograph feature makes it possible to work with lens aperture open by providing facilities for tilting of the negative itself, as well. By tilting either the negative or the paper, when the other is already tilted — the tilted elements are brought into alignment with a zone of sharp focus as shown in figures 4A, 4B and 4D, on page 354. The principle employed in Variography is, in its effects, not unlike that available in the Graphic View camera, where it is incorporated for altering the linear perspective on the negative itself.

In the Graflex Variograph Enlarger the negative tilt is secured by means of two variograph control-wheels (Fig. 15), the front wheel tilting the platen and negative fore-and-aft, while the rear wheel produces the lateral tilt. Spring-clicks mark the horizontal plane, and compression springs take up the backlash.

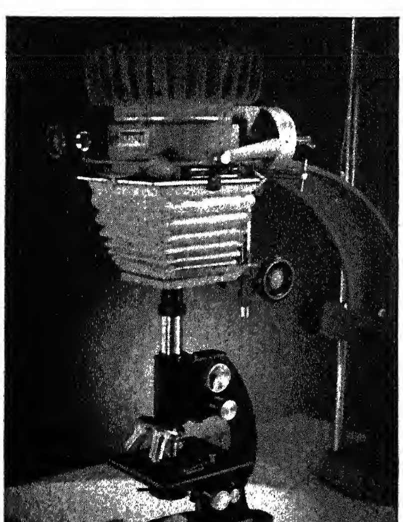
The other half of the variograph feature is embodied in the accessory Variograph Easel Holder, which consists of a Y-shaped member mounted on a ball-and-socket joint, upon a three-footed stand. With it the paper-holder can be tilted as much as 35° in any direction and locked by tightening down on a truly man-sized large ring directly over the ball-and-socket joint.

How Variography Works

In these diagrams, large and small diaphragm openings are indicated by the heavy line in the lens. The Zone of Sharp Focus is shown by a *shaded* area, and the portion of the Image that is sharp on the Paper is indicated by the *heavy* line on the easel. In Figure 4d, the sharp image is dotted.

Paper Alone Tilted

You can alter the linear perspective of a picture with any enlarger by tilting the paper. But this makes a lot of unnecessary extra work and limits the amount of control over perspective by the depth of focus obtainable.



17. The camera assembly coupled to a microscope.

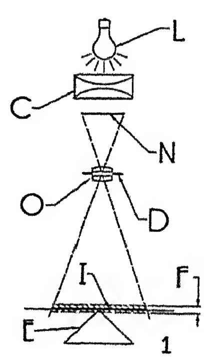
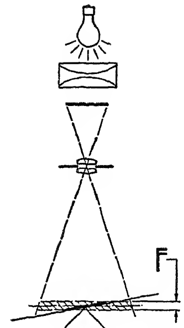


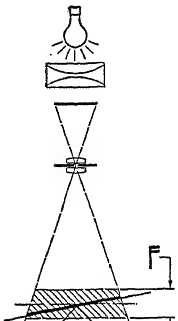
FIGURE 1. A normal straight projection. Negative and paper parallel, Diaphragm wide open, slight Depth of Focus. But the Image is uniformly sharp on the whole area of the Paper and the exposure is short.

L—Light Source
C—Condensers
N—Negative
O—Lens (objective)
D—Diaphragm
I—Sharp Image on paper
F—Zone of Sharp Focus (depth of focus)
E—Variograph Easel Holder

FIGURE 2a. With an ordinary enlarger you can tilt the Paper with the easel to alter the linear perspective. With the Diaphragm wide open, the Image is sharp in only the small area where the Paper cuts across the shallow Zone of Sharp Focus (depth of focus). Further, propping up one edge of the easel is an unsatisfactory makeshift.



2a



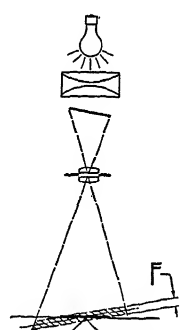
2b

FIGURE 2b. To make the whole Image *reasonably* sharp on the Paper you must close down the Diaphragm until the Zone of Sharp Focus is deep enough to include whole area of the Paper. This makes the Image very faint and difficult to focus, the edges may not be as sharp as you wish, and an *un*reasonably long exposure is required.

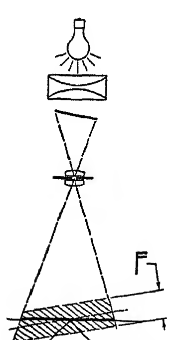
Negative Alone Tilted

In some enlargers you can tilt the Negative in one direction. This is no better than tilting the Paper alone because: it alters the perspective in only one direction, you must still stop way down, and you can't be sure the corners are sharp.

FIGURE 3a. With the Negative alone tilted and the Diaphragm wide open, the Image is sharp in only the small area where the shallow Zone of Sharp Focus cuts across the Paper—just as in 2a.



3a



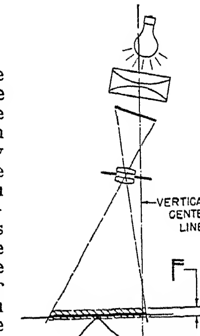
3b

FIGURE 3b. Here the lens is stopped down so that the Zone of Sharp Focus includes all of the Paper, but, again, the light is so weak that it's practically impossible to focus, and the exposure will be very long—just as in 2b.

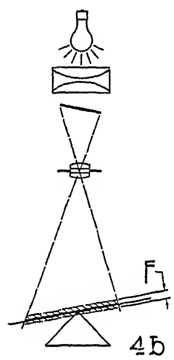
Both Paper and Negative Tilted

In the Graflex Variograph Enlarger you can alter the linear perspective quickly, surely, and accurately; you can make the whole Image sharp *with the Diaphragm open* and avoid needlessly long exposures. There are two ways to do this:

FIGURE 4a. By tilting the Negative you alter the perspective; by tilting the head in the same direction you make the Zone of Sharp Focus coincide with the Paper and the Image is uniformly sharp all over the Paper with a large Diaphragm. The Image is bright so you can focus easily and accurately, and exposure is short. The disadvantage is that the easel may have to move off the baseboard to permit centering the Image on the Paper and you can alter the perspective in only one direction unless you use the rotating negative carrier.



4a

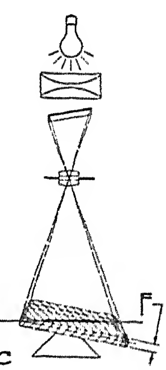


4b

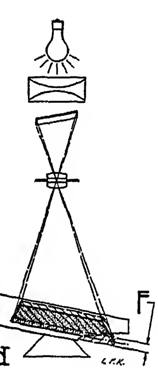
FIGURE 4b. By tilting both Negative and Paper (in *opposite* directions) you alter the linear perspective at will, work with a large Diaphragm to give a bright Image for accurate focusing and a short exposure, and you keep the easel on the baseboard. The accessory Graflex Variograph Easel Holder tilts the Paper in any direction (and the enlarger tilts the Negative in any direction), and holds it absolutely steady. This shows a tilt in one direction only.

There is one complete answer to the problem:

FIGURE 4c. This shows the Negative tilted in two directions, and the Paper horizontal. Only a portion of the Image is sharp, as in Figures 2a and 3a. Stopping down the lens is an unsatisfctory expedient, as we have seen above, because it reduces the intensity of the image and makes a long exposure necessary.



4c



4d

FIGURE 4d. With the Graflex Variograph Enlarger and Graflex Variograph Easel Holder—Negative and Paper both tilted in *two* directions, Diaphragm open. Complete alteration of both vertical and horizontal linear perspective, firm support for paper, bright image for focusing, and short exposure. Variography is as simple as straight projection.

Additional Features of Variograph Enlarger

It is often desired to employ a piece of darkroom equipment for purposes other than those for which it was primarily intended. The Graflex Variograph Enlarger has many features which permit its use for such other purposes. Among them are the rotating and removable head, which will be found useful for projecting images greatly enlarged on the wall or on the floor, when making murals. The enlarger head can be rotated up to 90°, either right or left.

Copying . . . View Camera Work

The platen of the enlarger is designed to accept an accessory photo-adapter for conversion of the lens-and-bellows assembly into a high-grade camera. The long bellows, coupled with suitable lens, converts it into a camera suited for portraiture, photography of small objects and copying. The photo-adapter accepts an accessory Graflex Photo Focusing Panel (ground glass) and a Graflex Sheet Film or Plate Holder. This assembly may be used either on the enlarger arm or on a tripod. For special work, a still or motion picture camera can be mounted on the enlarger head supporting arm for special work or copying (Fig. 16).

Macrophotography and Microphotography

Macrophotography is the process of photographing objects on a large scale, without a microscope. This is entirely feasible with the photo-adapter assembly of the enlarger, or with a camera mounted on the enlarger head support. The rigid supporting column and the substantial baseboard provide for maximum of freedom from vibration and greatest convenience in focusing and viewing.

Microphotography usually refers to copying drawings, book-pages, letters and other documents on 35mm film for convenience and economy of storage space. By replacing the enlarger head with a Graflex Photorecord Camera, or for that matter, with other suitable 35mm cameras, an ideal setup is provided for Micro-copying and Microphotography.

Photomicrography

The View Camera assembly mentioned previously is well suited for use with a microscope (Fig. 17). Either a Graflex or a Speed Graphic Camera, or any other camera possessing a removable lens and ground-glass focusing, can be used in connection with the enlarger head support of the Variograph Enlarger. The methods for making Photomicrographs are mentioned elsewhere in this volume (Chapter 22, page 319).

The ease with which the enlarger head support can be moved up or down and effortlessly fixed in any position makes it an ideal support for any still or motion picture camera which requires smooth and easy adjustments for focusing.

Tri-Color Separation Negatives

By substituting an interchangeable three-color separation filter carrier for the red glass focusing filter — three-color separation negatives can be made just as easily as projection prints. The unit is adequately light-tight, making it possible to carry out this work in perfect safety and comfort.

Chemicals for the Press Darkroom

Another important part of the darkroom is the chemical cabinet. In addition to having the stock chemicals which are always used, it may be advisable to have small cans of ready-mixed developers available. Many of the well-known formulas used in the newspaper darkrooms are also available in prepared form. The prepared developer naturally avoids the possibility of making any mistakes in mixing. The time-saving factor should also be considered. Then, there is the elimination of possible chemical waste. We have all had the experience of weighing out chemicals, being interrupted in the middle of the process and then coming back to the job to find out that we couldn't remember whether the hydroquinone or carbonate had been added or not. As a result the whole batch was thrown away and we started all over again. Then finally, the photographer is always assured that whoever mixed the developer there could be no possibility of mistakes when the next person used it.

On the other hand, the regular routine of mixing developers into stock solutions should be done by someone who is responsible for this work. This can be done once a week or whenever a new batch of developing solution is required. One way to avoid making mistakes is to weigh out each chemical proportion and leave it on a piece of paper in a row on the mixing table. Then pour each chemical into the bottle or tank in the order required. Around the newspaper darkroom nobody likes the job of mixing chemicals; however, it must be done and in every case this job must be done efficiently.

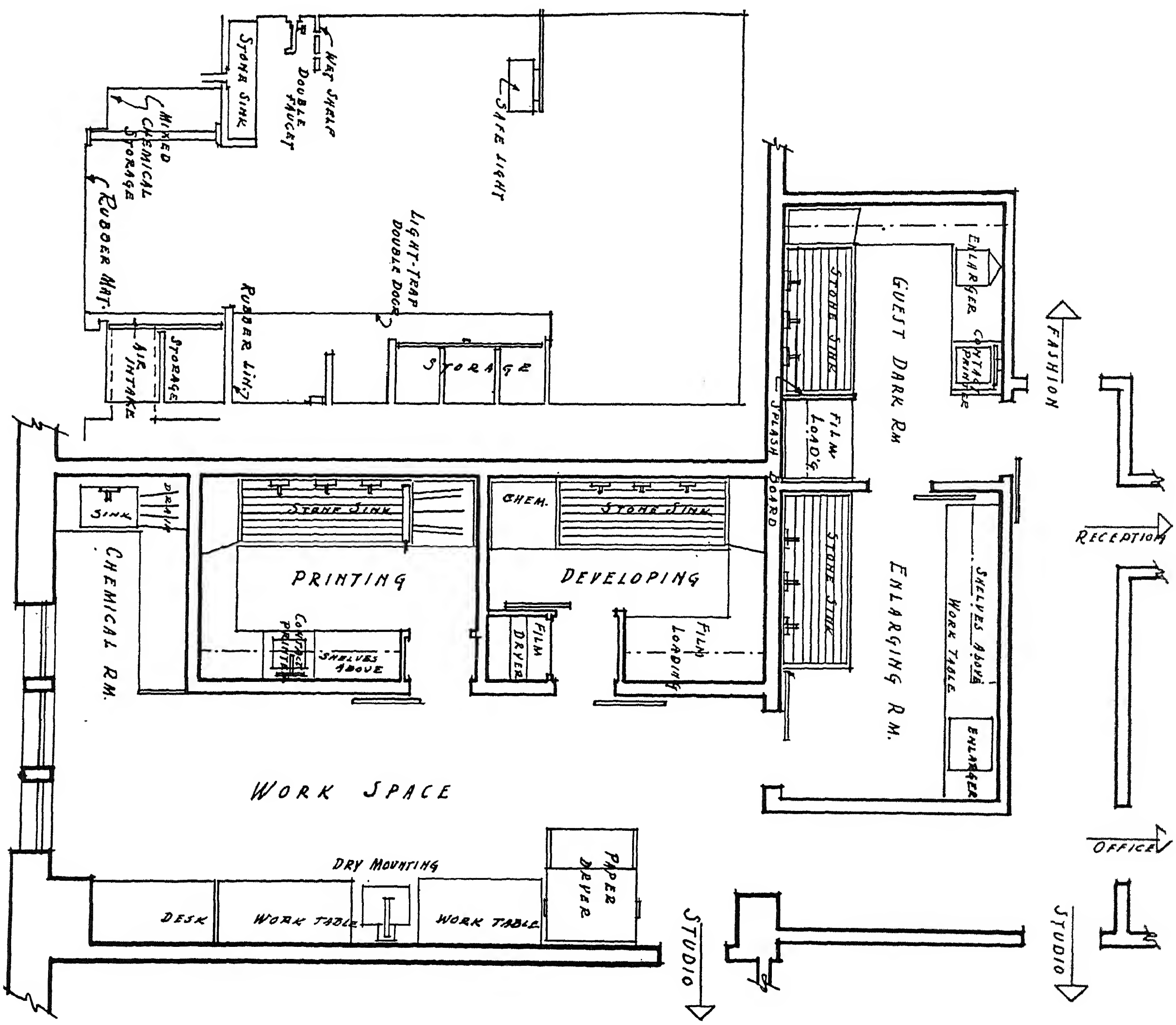
The average developing time for cut films is usually around two and three minutes. For this work the D-72 formula is used in many of the press darkrooms. Also for extremely fast work the D-82 formula is used. With this fast development of the negative and quick clearing in the fixing solution, the negative is placed in the enlarger without drying and a print can be delivered to the engraving department within six to ten minutes when required. The DK-50 formula is also commonly used for negative development. When it comes to fine grain development on the small films it will take a little longer because of the longer developing time required by such formulas as D-76, Agfa 17, DK-20, Panthermic 777, and others.

The *Rochester Democrat and Chronicle* has quite an efficient darkroom layout as will be noted from the accompanying floor plan. In this darkroom we find three individual developing rooms which open into the communal printing room. The whole layout is built for individual efficiency and speed. Note the adjacent studio space for all work outside of the darkroom. There is also plenty of good ventilation provided for.

Another type of newspaper darkroom layout is shown in the floor plan of the *Elmira Star Gazette*. Here we have a smaller photographic force which uses one main darkroom which is well laid out. The adjoining studio space gives provision for chemical mixing, special artificial light photography, and the storage of films and supplies. This room also provides a meeting place and desk facilities for the photographers. The floor plan and information about the *Elmira Star Gazette* darkroom were prepared by Wells Crandall, Chief Photographer (see page 344).

Increasingly greater attention is being given to photographic problems by fine magazines. Many of the weekly and monthly publications referred to by photographers as "the slick paper sheets" are installing excellent photographic studios and processing laboratories, to improve quality of photographic illustrations and to speed up their production schedules. These organizations stress quality greatly, and realize that speed and quality can be secured only by a combination of skilled workers given excellent mechanical equipment, and carefully planned working quarters.

Below is shown the photographic darkroom section of Vogue Studios, of the Condé Nast Publications, located in the Grand Central Palace, New York.



18. **"VOGUE'S" STUDIO DARKROOM.** The above plan, designed by Richard Carver Wood, shows the efficient layout for the larger size studio. The drawing contains complete data. Copyright Condé Nast Publications.

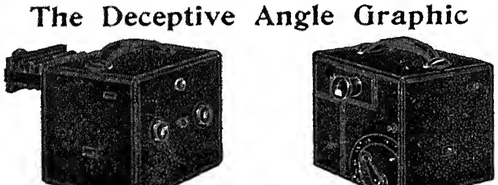
HOW TO USE THE GRAFLEX AND GRAPHIC CAMERAS

HENRY M. LESTER

Every modern camera is a direct descendant of a view camera, which in turn took *its* origin from the "camera obscura." Today the camera represents gradually accumulated improvements, refinements and features which were designed to meet specific requirements of photographers, whose problems have grown in number and in quality as photography reached into more and more specialized fields. Originally conceived to produce "a likeness" — the camera gradually developed from a simple "dark box" into an elaborate precision instrument as its tasks grew and multiplied until it is difficult today to enumerate all the purposes to which human ingenuity applies it. In this process of gradual evolution photographic cameras have acquired and lost and again re-acquired certain features, all to meet the demand of photographers for equipment equal to their current tasks. Some of those features were dictated by style, fads, or just capricious tastes. Modern cameras, as do modern automobiles, represent the sum total of features which have been developed and retained in conformance with the time-proven principle of "survival of the fittest."

The Graflex and the Speed Graphic cameras built and used just after the turn of the century were simple affairs. According to present-day standards of workmanship they were crude and clumsy, but many interesting examples of their work have survived their usefulness. To be sure, one could still take pictures with them, if one could wrest them away from their present proud owners.

The Deceptive Angle Graphic



2. The young blades of 1904 enjoyed candid camera photography with these "Deceptive Angle ' Graphics . . . .

I had the good fortune of looking at an extremely interesting booklet, which bears the following imprint:

> "CATALOGUE and PRICE LIST . . . 1904 . . . of PHOTOGRAPHIC APPARATUS and SPECIALTIES manufactured by The Folmer & Schwing Manufacturing Co. No. 407 Broome Street, New York, U. S. A. Telephone, 5923 Spring."

A really fascinating booklet! The earliest available forerunner of the brilliantly printed Graflex catalogs of today. It features such interesting items as: the Stereo Graflex . . . The Tourist Graflex . . . The Reversible Back Cycle Graphic . . . The Reversible Back Graphic Camera . . . The Graphic Naturalist Camera . . . The Triple Lens Stereo Graphic . . . ($305.00! . . .) and the "Deceptive Angle (!) Graphic" . . . This last item is of special interest to our present-day practices as it shows us that many of the "long-forgotten" features of old cameras are being revived these days. The reproduction of page 46 of that 1904 catalog is offered here as it aptly conveys the atmosphere of that thirty-eight-year-old publication.

The Deceptive Angle Graphic

Patent Applied For

The Graflex and the Speed Graphic

Available in a variety of models and sizes the Graflex and the Speed Graphic cameras differ from one another chiefly in the manner in which the object is viewed and focused upon. In other respects they resemble each other in their finish as well as in the operation of their controls. The Speed Graphic is a portable folding hand camera, essentially a view camera, stripped of some of its features, but provided with many others which permit its rapid and effective free hand operation under various conditions. It is intended chiefly for eye-level operation.

The Graflex camera is designed primarily for waist-level operation: the operator views the object upon a horizontal ground glass, hooded for greater convenience, up to the instant of exposure. This is accomplished upon the time-proven Graflex principle of employing a single lens, back of which is provided a plane mirror, which intercepts the image and projects it upwards upon the horizontal ground glass for focusing. For the exposure proper the mirror is swung out of the way. Aside from all other features of the Graflex camera the single lens reflecting mirror focusing is its most significant principle.

The Graflex type camera was evolved from the prototype of all cameras, the view camera, after it became apparent that photographers who wished to do portraits, landscapes, pictorial work and all sorts of photography "on the go," while traveling, without bulk of equipment and delay of setting it up, would be served better by a self-contained camera, which could be used:

with, but mostly without, a tripod;

without focusing cloth;

with the photographic plate or film in position and ready for exposure;

with the image of the object visible up to the instant of exposure;

with the image of the object being formed upon the ground glass through the same lens which forms the image upon the film so that its sharpness, depth of field and the composition were plainly visible;

with the ground glass being set horizontally and the camera held at waist level to assure comfortable visibility;

with an efficient shutter that would work independently of the lens;

with a viewing arrangement for the image to be right side up;

with interchangeability of lenses;

with the camera collapsing into the least bulk with greatest rigidity and accuracy.

When these requirements were met, probably one by one, the Graflex camera was born! And here it is:

A neat, almost square box, made of seasoned and carefully milled Honduras mahogany, carefully and permanently covered with fine leather, with a sturdy leather handle. . . . The few metal parts appearing on the outside look rugged, and their dull gun-metal gray finish inspires confidence.

The Speed Graphic is essentially a hand camera which projects the image formed by its lens directly back to the focal plane. The operator does not see the image as the plate or film receives it, but views his object through one of two available view finders. Through the view finder the operator sights, centers and composes his picture which is brilliant but of a different size than that formed in the focal plane. Through the view finder the operator can only aim the camera to "cover" the field which appears to his eye. However the view finder does not give him any information on the picture's sharpness, or depth of field. To focus the camera sharply upon the object the operator can use the ground glass or employ an accessory lens-coupled range finder, unless he is one of those old-time sharpshooters who estimate their distances by experience with such unfailing accuracy that they boast of never having taken an unsharp picture. As to the depth of field, most experienced operators know their lenses so well that they manage to get what they want in sharp focus all the time, letting the rest take care of itself. Besides, since most of them use flashbulbs or synchronized flash in their work, and employ the smallest lens apertures, they get everything in focus!

The Speed Graphic is almost always used at eye level. The "stance" of a newspaper man shooting with his Speed Graphic is one of the most characteristic poses. (See pages 201, 203, and 205.)

Why the Graflex or Speed Graphic?

To understand the difference between these two types of cameras and to realize why the Graflex and why the Speed Graphic, in their own specific fields of photography, it is best to start the camparison from their points of similarity.

BOTH THE GRAFLEX AND
THE SPEED GRAPHIC HAVE:

Mahogany, leather-covered bodies

Durable bellows

Rack and pinion focusing arangement

Interchangeable lenses or lens-boards

Choice of accessories (see Graflex and Graphic Accessories) to take sheet-film or plate magazines, sheet film or plate holders, film pack adapters, or roll film holders.

Provision for Ground Glass Focusing.

Graflex Focal-Plane Shutter.

ONLY THE SPEED GRAPHIC HAS *(Or Can Have):*

"Between-the-lens," Compur-type shutter
Broad exposure range: 1 second to 1/1000 sec.
Cable release or finger-tip control of focal-plane shutter.
Parallax-correcting view finder
Peep-sight view finder (wire-frame)
Lens-coupled range finder
Choice of the Graphic or Graflex Back.
Vernier Focusing Scale
Certain Synchroflash features
Rising front (all models)
Built-in focal-plane synchronizer for flash photography (some models) up to 1/1000th second.

ONLY THE GRAFLEX HAS *(Or Can Have):*

Lightproof, collapsible, self-erecting removable focusing hood.

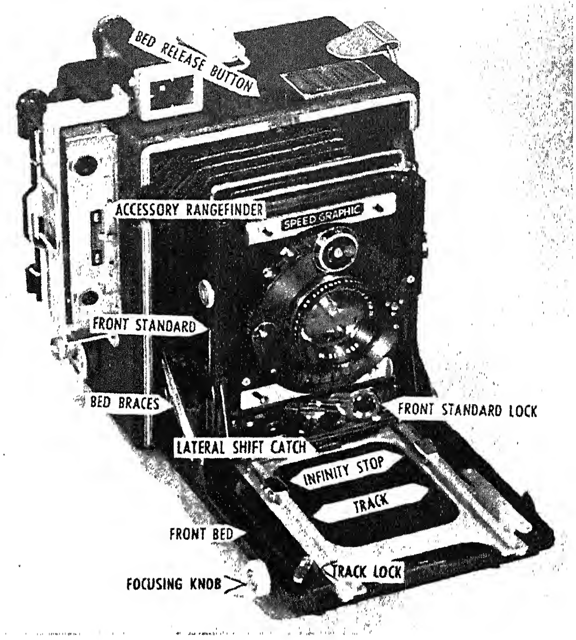
Revolving back (some models are without them) for vertical or horizontal pictures obtainable from normal position of camera.

Externally silvered mirror reflex focusing through the "taking" lens.

Upright view of object up to the instant of exposure showing full negative size image.

Visual focusing, actual observation of sharpness, depth of field, composition of picture, film in position for instant exposure throughout the entire period of ground glass focusing.

Automatic Diaphragm Control, permitting focusing with wide open lens, automatically stopped down at the instant of exposure.



3. LATEST VERSION OF SPEED GRAPHIC with its features and controls labelled. The 3¼ x 4¼ size is shown here—the 4 x 5 model is practically identical except for size. The range finder is not standard equipment. It should be carefully and expertly fitted to the specific lens.

The Speed Graphic

As the Graflex evolved from a view camera to meet the demands of pictorial, portrait and travel photography, where *fine quality* pictures mattered more than speed of operation, where the photographer *had* to see the picture in every way, as it was to appear on the negative—so the Speed Graphic grew from its prototype to meet the exacting demands of the press photographer, of the news cameraman, of the man who had to "get" what his eye saw—the moment he saw it. This

4. FIVE SARNO BROTHERS: DICK-TONY-HENRY-JOHN-JERRY, all using 4 x 5 Speed Graphics. According to available records these are the only five brothers who are all newspaper photographers in the country. Photo by Richard Sarno.

should not be understood to mean that either the Graflex or the Speed Graphic could not be employed for purposes other than those specifically indicated for them. On the contrary these cameras are flexible and easily adaptable for work other than that directly intended for them. Many a fine "pictorial" has been made with the Speed Graphic, and many a "press scoop" with the Graflex.

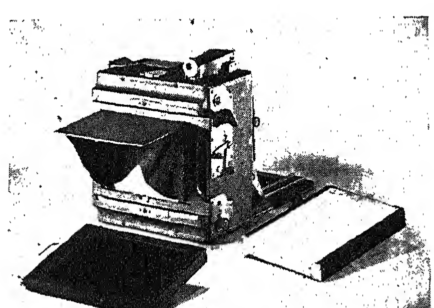
The Speed Graphic is so intimately associated with the work of the press that it has almost become a symbol for a reporter. An amateur equipped with a Speed Graphic and a synchronizer is frequently admitted within police and fire lines.

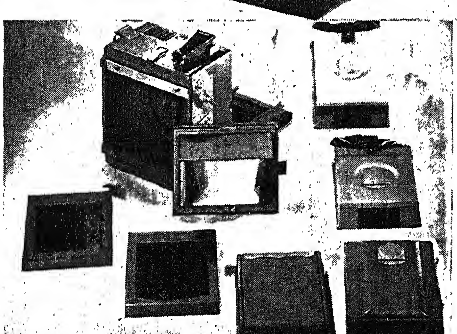
The Speed Graphic is essentially a modern version of a folding hand-camera to which the important focal plane shutter feature has been added. It is available in the following popular sizes given in inches:

$2\frac{1}{4} \times 3\frac{1}{4}$; $3\frac{1}{4} \times 4\frac{1}{4}$; 4×5; 5×7.

Aside from the difference in size all four models of the Speed Graphic are essentially alike in most of their salient features and their operation. When closed each of these cameras appears as a black leather-covered, rectangular box. Made substantially of carefully machined, mitered well-seasoned Honduras mahogany, rigidly reinforced internally with metal brackets and angles, every Speed Graphic is impressive in that it looks and feels rugged and full of stamina.

4a. The *Graphic* back with built-on focusing panel and the film attachments it accepts. This panel pulls back so that the attachments may be slipped into the camera.





4b. The *Graflex* back with removable accessory focusing panel and wide range of film and plate attachments. The focusing panel when used is removed after focusing and then replaced with desired film attachment.

The camera is opened when a spring button at its top is pressed. The camera bed swings out and is locked . . . suspended upon its spring activated side arms, revealing inside the camera, the "front standard" supporting the lens board. The front standard lock, turned forward, releases the standard and permits its withdrawal upon the bed track until it reaches the "infinity stops" fastened to it at the factory. It is locked to the track in this position by rotating the locking lever to the left or right. This places the lens firmly in the position from which it can readily be focused either for "infinity" or upon any object desired. For focusing upon objects nearer the camera than "infinity," the camera lens must be moved forward—away from the film plane. For this purpose the front standard which carries the lens, can be advanced with the sliding track by means of the knurled focusing knob, Figure 3.

The distance from the camera to the object upon which the lens is focused sharply is indicated in feet upon a graduated focusing scale attached to the camera bed. Earlier models of the Speed Graphic have a pointer at the base of the lens standard, which indicates footage markings on the scale. Latest models are equipped with what is known as a vernier-type scale which consists of two scales adjoining each other closely: each has the same engraved markings, except that one is longer than the other. When the same footage numbers come opposite each other the camera is in perfect focus for that distance. This type of footage scale is much more accurate. The vernier footage scales are pre-set and calibrated at the factory with great accuracy. Each camera has its focusing scale calibrated especially for that lens with which it is furnished. Using this scale with any other lens, even of the same make, speed and focal length, may produce unsharp pictures.

Focusing

The Speed Graphic provides three different ways of focusing:

1. *By Focusing Scale:* With camera-to-object distance known (measured or estimated), the camera lens can be preset to that distance upon its focusing scale.

2. *By Range finder:* If the range finder is coupled to the sliding track, it is functioning in synchronization with the movement of the lens, thus providing focus automatically.

If the range finder is not coupled to the track, but is of the "indicating" type, its footage indication is noted and the lens pre-set to the proper distance by means of the indicating focusing scale. (More about the range finder on page 366).

3. *Visually:* Through the ground glass provided in the Graphic Focusing Panel. This method, while slower, has the advantage of permitting the operator to "judge" and to see the depth of field available and the sharpness of the picture and to determine the composition of the picture with any lens used.

Graphic or Graflex Back?

Speed Graphic cameras may be purchased with either "*Graphic* Back" or "*Graflex* Back." Because both these backs

permit ground-glass focusing and provide for the use of interchangeable film attachments, the photographer's choice should be guided by the versatility he desires and the uses to which he expects to put his camera.

The *Graphic* back is constructed with the ground-glass focusing panel permanently attached to the camera. This panel is mounted on springs which permit it to be pulled back so that a film attachment can be slipped into the camera with the film at the focal plane. On the 4 x 5 Speed Graphic, this back accepts the *Graphic* sheet film holder, *Graphic* plate holder, and Kodak film pack adapter. On the 3¼ x 4¼, it accepts the *Graphic* sheet film holder and Kodak film pack adapter. The 2¼ x 3¼ Miniature Speed Graphic with *Graphic* back accepts the *Graphic* sheet film holder and *Graphic* film pack adapter.

The *Graflex* back utilizes the accessory *Graflex* focusing panel which must be attached for focusing, removed, and replaced by the desired film or plate attachment. This back accepts the *Graflex* focusing panel, *Graflex* sheet film holder, *Graflex* plate holder, *Graflex* sheet film magazine and, with the exception of the 2¼ x 3¼ Miniature, the *Graflex* plate magazine and roll holder.

The *Graphic* back is used most frequently by news photographers . . . principally because of the greater rapidity with which the double sheet film holders preferred by the press can be interchanged or replaced after the image has been viewed on the ground-glass focusing screen. The *Graflex* back is usually considered the more versatile, since it accepts a wider range of accessories including the very convenient *Graflex* sheet film magazine.

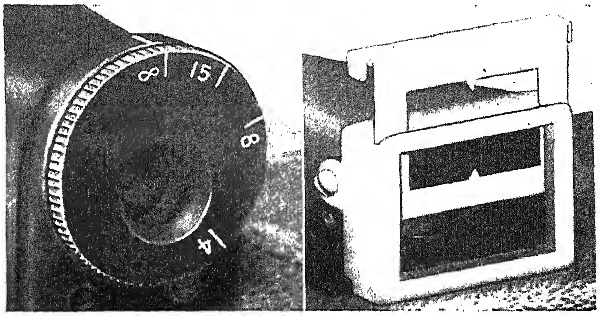
The spring-actuated focusing panel is provided with side shields to keep extraneous light away from the ground glass. These shields in connection with the rigid protective cover of the panel form an effective collapsible hood, which springs open when a small latch is pressed down.

To focus upon the ground glass both the focal plane and the front, between-the-lens shutters (which are described in detail later) must obviously be open. Also, if the Graphic back is employed, the film or plate holder or the film pack adapter must be withdrawn. The full negative size will appear upside-down upon the ground glass, the sharpness of which can be obtained by moving the lens forward or backward with the knurled focusing knob.

View Finders

For rapid work with the Speed Graphic, for photography of moving objects, where no time can be lost for focusing and composing the picture upon the ground glass, a view finder through which one can see the field covered by the camera lens is indispensable. A view finder does not do all a ground glass does; it only shows us what portion of the entire scene before the camera will appear on the ground glass and on the negative. The view finder does not show us whether the lens is sharply focused upon the subject nor does it show us the depth of field at the given setting of the lens. In other words, of the three important functions of the lens, angle of view, sharpness of focus and depth of field, the view finder is intended to give us correct information on the first, the angle of view or "lens coverage."

Most view finders available for the Speed Graphic are intended for photography of subjects at from 15-20



5. TUBULAR VIEW FINDER showing front and rear features with parallax adjustment. The excentric eye piece is adjustable. The front mask is interchangeable.

feet and beyond. At that distance the field and angle of view covered by the camera lens and by the view finder are approximately the same. Due to the fact that the lens and the view finder are never on the same optical axis, when photographing objects close to the camera, an adjustment must be made in the axis of the view finder to compensate for what is known as the "parallax" (the difference between fields and angles of view of two optical systems set parallel and close to each other).

Every user of the Graphic has welcomed the appearance of the Tubular View Finder with parallax adjustment and with interchangeable masks (for different lenses), which marked an important advance in the design of the Speed Graphic, having extended its usefulness and application in speed photography. Standard equipment on all new Speed Graphics (except the 5 x 7) the Tubular View Finder is available as an accessory for older Speed Graphics. It is easily installed for it is packed in a box, the bottom of which forms an ingenious template guide for its installation.

The Graphic Tubular View finder is provided with an interchangeable mask which slips into a narrow channel at its front. Each of these masks has four small protruding "centering notches" which are seen when looking through the view finder and enable the operator to estimate correctly the center of the field. When looking through this view finder one should see all four edges of its "framing" surrounding the object aimed at. There is a suitable mask for matching each camera lens. When correctly installed the tubular view finder will very closely indicate the field of view for any distance from four feet to infinity in the case of the Miniature Speed Graphic, and for six feet to infinity in the case of the larger models. The parallax adjustment for the various distances is easily made by rotating the knurled excentric eye-piece of the view finder until the footage number appears at the top of the scale.

The Interchangeable Masks

The front of the finder can be fitted with different masks indicating the field of view included by different lenses. The

following table should be used to determine which masks will match any particular camera and lens combination. Note that whereas in some instances a single mask may be used for several lenses of slightly different focal length, each mask has been calculated in such a way that in each instance there is a margin of safety permitting working to the extreme edges of the field included by the masks.

While it is impossible to supply a different mask for every Speed Graphic camera and lens combination because of the vast number of lenses accepted by these cameras, the standard masks will be found to be well within the limits of reasonable accuracy, each insuring that all subject matter seen through the finder will be on the negative.

Masks for other lenses can be obtained on special order. Because of the limitations of the size of the front of the finder, these masks can be supplied only for lenses of normal and long focal lengths.

TABLE SHOWING STANDARD MASKS AND LENSES SERVED BY EACH ON VARIOUS SPEED GRAPHIC CAMERAS—*Figures below give focal lengths of lenses in inches.*

2¼x3¼	3¼x4¼	4x5	*Mask Number*
——	4½—4¾	5 — 5⅞	4
3¼—3⅞	$4\frac{13}{16}$—5¼	$5\frac{15}{16}$—6⅜	3
$3\frac{15}{16}$—4½	$5\frac{5}{16}$—6	$6\frac{7}{16}$—6⅝	2
$4\frac{9}{16}$—5	$6\frac{1}{16}$—7	$6\frac{11}{16}$—8½	9
$5\frac{1}{16}$—6	$7\frac{1}{16}$—8	$8\frac{9}{16}$—9½	10
$6\frac{1}{16}$—7½	$8\frac{1}{16}$—8½	$9\frac{9}{16}$—10½	11
$7\frac{9}{16}$—7¾	$8\frac{9}{16}$—12	$10\frac{9}{16}$—13½	8
$7\frac{13}{16}$—9½	$12\frac{1}{16}$—13⅞	$13\frac{9}{16}$—15	7
$9\frac{9}{16}$—11⅞	$13\frac{15}{16}$—16	$15\frac{1}{16}$—16⅞	6
$11\frac{15}{16}$—13	$16\frac{1}{16}$—20	$16\frac{15}{16}$—20	5

Other Graphic View Finders

Two other types of view finders are available for the Speed Graphic. The Wire Frame Finder consists of two parts: a folding or swinging Peep-Sight frame at the rear of the camera top and a rigid rectangular Wire Frame at the lens standard. In its latest form the wire frame is ingeniously and effectively concealed, telescoping within its own sides behind the lens standard. Thus, whether in use or not, it is entirely out of the way and does not interfere with changing lens boards, attaching cable releases, flash synchronizer trippers, etc. For use the wire frame is fully extended from its telescoped position and the peep-sight is erected. The eye should be placed as closely as possible to the peep-sight: that portion of the viewed area will be included in the field of the lens which is seen within the limits of both the peep-sight and the wire frame finder. The wire frame finder is especially useful for following of moving objects: they appear through it erect, full size and from eye-level position.

Experienced Speed Graphic operators use this wire frame finder with both eyes open, which enables them to judge perspective better, and also to see moving objects approaching the field of view, as in races, ball games, etc.

The Graphic View Finder, now superseded by the tubular view finder, was formerly fitted to the Speed Graphic cameras. It served primarily for proper centering of the photographed subject. Collapsible and folding neatly out of the way it consists of a sighting bar and a finder lens upon which are engraved horizontal and vertical cross-hairlines. Sighting across the V-notch and the intersection of the two hairlines at the subject places it in the center of the area of the picture.

Rising Front

Raising or lowering of the lens will permit reproduction of vertical parallel lines as such on the film.

If a photographed subject is higher than can be accommodated by the angle covered by the lens, it is best, if possible, not to incline the camera, but while holding the back of the camera parallel to the subject, bring it into the field by raising the lens. This is easily accomplished by loosening the knurled knobs on either side of the lens standard, and tightening them again after adjusting the lens to the desired height. It is important to remember to re-center the lens before closing the camera. To re-center the lens rising front it should be brought down until its top is flush with the sides of the front standard.

Lateral Shift

The lens standard of the Anniversary Speed Graphic is provided with a lateral or sideways shift in addition to the rising front. This shift is useful in two ways. First, it provides a rising front adjustment when the camera is turned on its side for "vertical" pictures. Second, it may be used with the camera in normal position to avoid excessive convergence of horizontal lines in perspective. In photographing a building, for example, in which the front is desired "square on" and also showing one side of the structure, the camera is placed parallel to the front of the building, but sufficiently to one side of center to show the side of the building. The lateral shifting front is shifted till the picture is correctly framed on the film, still keeping the camera parallel to the front of the building. The front should be recentered before closing the camera.

Lens Board

A most desirable feature of the Speed Graphic design is the ease with which lenses can be interchanged. Each camera, as it leaves the factory, is a carefully matched and calibrated instrument, with its lens thoroughly matched to its own infinity stop, view finder, range finder and focusing

scale. The availability of inexpensive lens boards coupled with the simple locking slide feature of the front standard (which, incidentally, employs the same principle for rigidly securing the lens board as is used for connecting all Graflex film and plate accessories to the Graflex back), makes it possible to use accessory telephoto and wide-angle lenses mounted on lens boards for quick interchangeability with the standard lens. Accessory lenses are usually provided with flanges which are fastened to lensboards with the aid of a few small screws. As a rule, unless one has the necessary tools for centering and cutting of holes in lensboards, the mounting of accessory lenses is best delegated to your photographic dealer.

Double-Extension Bellows

A useful feature of Speed Graphics is incorporated in the camera's pleated bellows, which can safely be extended to about double the length of the standard focal length lens. At that point, the standard lens would yield a full-size image of the object (1:1 ratio). This feature is indispensable when working with lenses of longer focal length or when using the standard lens at close range to the object. It is then necessary to extend the front standard beyond the point established by the firmly and accurately pre-set infinity stops and the available track extension. The infinity stops themselves *should not be moved*. Instead, the front standard should be returned entirely into the camera housing, the camera bed dropped (See: "Wide-angle Lenses"), which will permit the standard to slide forward and off the short rear section of the track. The camera bed is then snapped back to its horizontal position and the front standard carried forward and slipped onto the *front end* of the main track. Locking the standard now anywhere upon the track, the focusing can be accomplished by means of the knurled focusing knobs. Obviously, focusing can now be done only on the ground glass, the range finder and the focusing scales being ineffective while the lens standard remains anywhere on the forward part of the track.

To do the same thing with earlier models of Speed Graphics, the sliding track is racked forward about an inch or so. The front standard is then slipped off the rear of the track entirely. The sliding track is then racked all the way back, the front standard lifted forward and its channel slipped upon the front end of the sliding track.

Wide Angle Lenses

Accessory wide-angle lenses can be used advantageously for work in close quarters, such as is encountered in architectural interiors, exteriors in cities, etc. When short focal length lenses are used, the front standard of the camera need not be withdrawn much beyond that part of the track which remains stationary within the body of the camera. It is sometimes necessary to drop down the camera bed lower than its normal open position to eliminate the possibility of it appearing in the picture and for greater ease of manipulation.

The new Anniversary Speed Graphics (3¼ x 4¼ and 4 x 5) are equipped with all-metal drop beds which can be dropped down well out of the range of the most extreme wide-angle lenses. This bed locks rigidly in position when dropped, preventing its changing position accidentally. An additional feature of these new dropped beds (which are of all-metal construction in all models except the 5 x 7 Speed Graphic) is a provision for rack-and-pinion focusing, by means of the two-piece "linked" tandem track. This is a real convenience in work with wide-angle lenses, amplified by the fact that dual focusing control, operated by either the right or the left hand may be used exactly as for normal and for long focus lens.

When short focal length lenses are used, the front standard of the camera is usually moved back or to the rear section of the track within the camera body.

Auxiliary wide-angle beds are available as accessories for earlier models of Speed Graphic cameras to permit limited racking out of the front standard, for wide-angle lenses beyond the stationary part of the camera track. The auxiliary wide-angle bed is connected to the camera after the standard camera bed has been dropped. To drop the camera bed for wide-angle lens work, the camera should be partly closed, until the circular portion of the cut-out part of the supporting side arm will meet the guide pieces. The side-arms are then slipped off those pins and the bed allowed to drop out of the way. The auxiliary wide-angle bed accessory is available only for the 3¼ x 4¼, and the 4 x 5 Speed Graphic cameras of earlier vintage.

Exposures

The Speed Graphic camera is provided with two systems of shutters, operating independently of one another, and providing the widest possible range of exposure variations to suit all requirements. The Graflex focal plane shutter offers the efficiency and dependability of 24 different exposures ranging from 1/10 of a second to 1/1000 of a second and "time." This shutter is entirely built into the body of the camera, where it remains out of harm's way for the life of the camera.

The other shutter is the front, sometimes referred to as the "between the lens" shutter. In latest cameras it is usually the "Supermatic" shutter having 9 speeds from 1 second to 1/400 second, plus "Time" and "Bulb." These shutters have a built-in self timing device, and a new type of "press focus" button. By the use of this button, the shutter may be opened for focusing without changing the speed setting, while the shutter is cocked. When the shutter is again closed by recocking after focusing, it is ready to shoot without further adjustment. Some foreign lenses are supplied in Compur or Compound shutters, with speeds ranging up to 1/100, 1/200, 1/250 or 1/400 second depending upon the type of the particular shutter.

Graflex Focal Plane Shutter

The Graflex focal plane shutter mechanism is built around a curtain made of a special fabric, so woven and so treated that it is impervious to light. This curtain rolls up on two rollers built into the back of the camera.

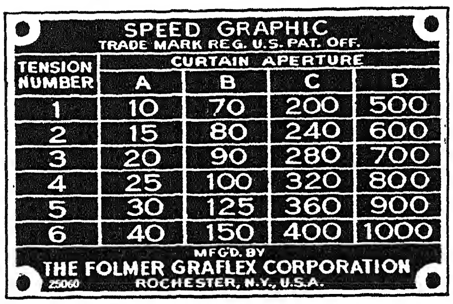
6. THE GRAFLEX FOCAL PLANE SHUTTER CURTAIN showing apertures ranging from approximately ⅛ inch in width up to full negative size opening.

One of these rollers has a controllable tension spring, regulated by turning the milled knob (B) counter clockwise, producing any one of the six available degrees of tension. The actual length of this curtain depends upon the size of the camera. Five carefully bound slits are incorporated into this long curtain: the narrowest measuring approximately ⅛ inch, the next slit measures about ⅜ inch, the next about ¾ inch, and the one adjoining it is about 1½ inches wide.* The last and the largest slit forms actually an opening, slightly larger than the film size of the camera.

* These are not the exact widths of the openings.

Any one of the slits can be made to pass in front of the focal plane at any one of the six available speeds. Thus it is possible to produce any one exposure selected from the shutter speed table T.

The shutter speed table T attached to the camera indicates approximate shutter speeds in fractions of seconds obtainable in combination with tension numbers 1 to 6 and the various curtain apertures which appear in window F. These curtain apertures are marked on the shutter speed table as $\frac{1}{8}$, $\frac{3}{8}$, $\frac{3}{4}$, $1\frac{1}{2}$, or in the case of newer cameras D, C, B, A, respectively.


SPEED GRAPHIC
TRADE MARK REG. U.S. PAT. OFF.

TENSION NUMBER	CURTAIN APERTURE A	B	C	D
1	10	70	200	500
2	15	80	240	600
3	20	90	280	700
4	25	100	320	800
5	30	125	360	900
6	40	150	400	1000

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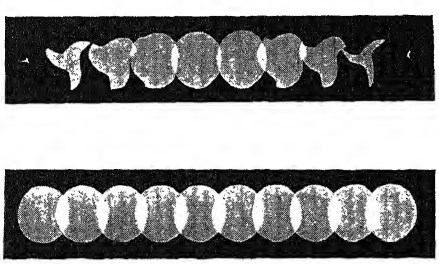
THE FOLMER GRAFLEX CORPORATION
25060 ROCHESTER, N.Y., U.S.A.

8. **TEMPLATE** indicating shutter speeds obtainable at various focal plane curtain apertures and tensions.

Tension numbers appearing in the window G are indicated by numbers from 1 to 6, the highest number indicating the greatest speed of any given curtain aperture. To decrease the speed of the shutter, the tension should be released by moving the escapement mechanism (B) back and forth until the required lower tension number is registered in the window (G).

Thus it is possible to obtain 24 various exposure lengths through combining the various spring tensions with curtain slit sizes.



7. *Upper strip* indicates that the between-the-lens shutter is "wide open" only during the fifth and sixth flashes.

Lower strip, made with a Graflex focal plane shutter, shows uniform illumination throughout.

From actual photographs made through same lens during exposures of 1/100 second. Each flash represents 1/1000 second.

The shutter curtain is set by turning key (A) counter clockwise until the desired curtain aperture, which is selected on the shutter speed table for a specific exposure, appears in window (F). If the curtain is already set so that any one of the smaller apertures appears at (F), the curtain should be released by pressing shutter release lever (M) until the desired aperture appears in (F).

Thus if an exposure of say 1/300 second is desired, select a figure on the shutter speed table nearest to 300, which may be 1/280 second or 1/320 second. In the first instance the tension number and curtain aperture combination would be: tension number 6, curtain aperture $\frac{3}{8}$. In the second instance it would be tension number 1, curtain aperture $\frac{1}{8}$.

It is important to remember two things when working with the Graflex focal plane shutter: First, the slide of any film or plate holder, film pack adapter, cut film magazine, must be in a closed position, covering the photo-sensitive material when the focal plane shutter is being set. It will be fogged otherwise. Second, the between-the-lens shutter must be set for "time" and opened. Obviously if the front shutter is to be used the focal plane shutter must be set to "open."

The focal plane shutter is set at "open" when the letter O appears in the curtain aperture window.

When the focal plane shutter has been set in accordance with the above directions, the slide of the film or plate holder should be carefully withdrawn, and the shutter release M drawn back carefully to prevent jarring or otherwise upsetting the balance of the camera. The use of cable release in connection with the focal plane shutter is earnestly recommended as it is capable of a much more even and steady exposure than the free hand movement.

It is the best practice to accustom one's self to a few essential steps in the operation of the Speed Graphic camera, the constant repetition of which in a definite order will become a strong habit, never to be altered and never to be forgotten. These steps are as follows:

1. Set the curtain tension. (*It's easier to do this first!*)
2. Set focal plane shutter aperture.
3. Withdraw dark slide of film holder.
4. Make exposure.
5. Replace dark slide of holder with darkened side of the handle to the outside to signify that this film has been exposed.
6. Reset curtain aperture key for next exposure, unless giving almost three times the previous exposure is contemplated for the next picture.

The Speed Graphic operator who wishes to be proficient in its use, will train himself to carry out these operations in this sequence so mechanically that he will perform them even during a conversation, or while on the run for the next shot.

Time Exposures with Focal Plane Shutter

It is thoroughly practical to make time exposures with the Graphic focal plane shutter by setting the curtain aperture until the capital letter T appears in the window. Drawing the exposure lever back will bring the

curtain aperture to the O, or open, position. Another movement with the exposure lever will close the aperture. It is recommended, when making time exposures, that the tension be set to at least No. 3. At lower tension numbers the movement of the curtain is apt to be too sluggish, unless the camera is in new condition, while at the higher tension numbered settings it may be too rapid for the steadiness of the camera.

Front Shutter

The front shutter of the Speed Graphic camera is used to supplement the focal plane shutter and provides a range of controlled shutter speeds as slow as one second. It also has "Time" and "Bulb" exposures in addition to fractional exposures ranging from ½ second up to 1/400 second (in some types of shutters).

The front shutter is frequently referred to as the "between-the-lens" or "diaphragm" shutter, as it is built in between the front and rear components of the photographic objective, just behind or just in front of the diaphragm leaves. The "shutter" action consists of rapid opening and closing of several blades of very thin metal, their movement being from and to the center of the lens. Most front shutters have settings for "time" exposures, "bulb" in addition to automatically controlled speeds of 1 second, 1/2, 1/5, 1/10, 1/25, 1/50, 1/100, 1/200 or 1/250, and sometimes 1/400.

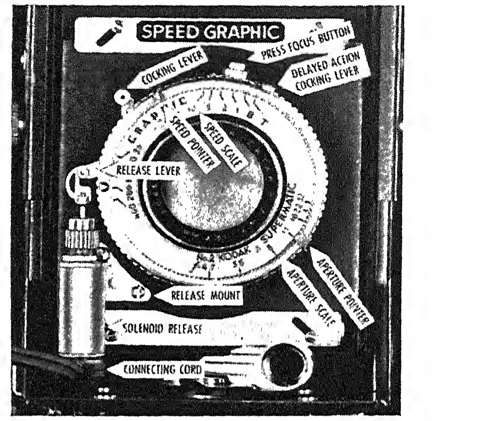
The front shutter may be used, if desired, whether its controlled speeds correspond to those of the focal plane shutter or not. It must be used for synchroflash exclusively, unless the camera, as in the case of the Miniature Speed Graphic, is equipped for focal plane synchronization.

The more popular models of the Compur Shutter are shown in the illustration on page 55. In addition to those usually referred to as the Dial-set Compur shutter, the Rim-set Compur shutter and the Press Compur shutter the new Supermatic shutters should be mentioned as available in two types: the Kodak Supermatic and the Supermatic Shutter with the Press-Focus Button.

The Supermatic Shutter

The Kodak Supermatic shutter is of the rim-set type, with 9 speeds ranging from 1 to 1/400 second plus "Bulb" and "Time" and is provided with a built-in, delayed-action mechanism ("self-timer"). Some of the Supermatic shutters have a built-in Press-Focus Button. With this latter feature the shutter can be set to any speed, released while pressing down on the Press-Focus Button, focused, and recocked. The Press-Focus Button then automatically disengages itself.

The upper face of the Supermatic shutter has the shutter speed scales engraved upon it. The scale is divided into two sections, each with its own speed pointer on the rotating rim. The black pointer indicates black speed marking, while the red pointer sets against the red markings. The former, ranging from 1/25 of a second through to 1/400 of a second, are generally safe for hand-held exposures, while a tripod, or some other firm support, should be used with the slower



KODAK SUPERMATIC SHUTTER lens mount. A typical installation on a Speed Graphic shown with the new Graflex Flash Synchronizer Solenoid Release (tripper) connected to the release lever.

speeds (red markings). The setting to any shutter speeds may be effected before or after cocking the shutter. Settings between the marked speeds will not produce intermediate exposure time values.

Supermatic shutters are provided with a cocking lever and a release lever. The release of the shutter is effected either by moving the release lever counter-clockwise or by using the cable release. Unlike most other shutters, the Supermatic must be cocked not only for instantaneous exposures from 1 to 1/400 of a second, but also for "Time" and "Bulb" exposures.

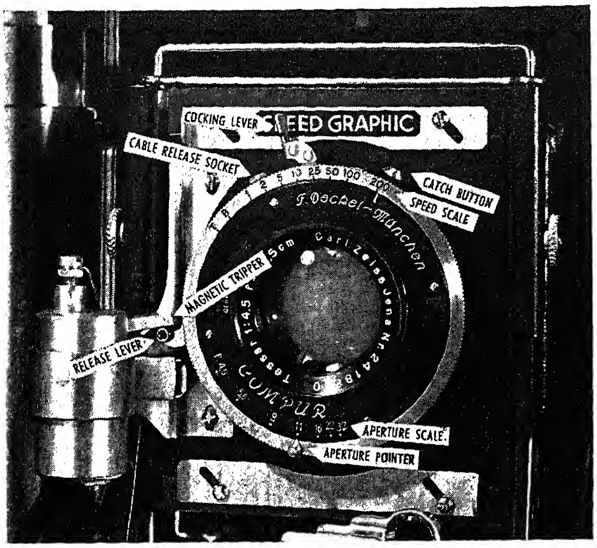
The delayed-action mechanism ("self-timer") has its own cocking lever, which should be moved clockwise *after* the shutter itself has been cocked. It is released by the regular release lever and automatically effects the exposure following a delay of from 10 to 15 seconds. This feature is not only useful when the photographer wishes to get into the picture but also for releasing the shutter without a jar when low shutter speeds must be used with a camera held in the hand.

Caution: Lens cells should not be removed from Supermatic shutters. Also these shutters should not be removed from the lens boards by turning: Their rotating is prevented by a pin fitted into the lens board.

Dial-set Compur Shutter

The speeds of this shutter are controlled by means of a small dial usually found at the top of the shutter housing, which is revolved to indicate speeds ranging usually from 1 full second through 1/5, 1/10, etc., to 1/200 second. The dial will turn from figure 1 to 200 through figures 5, 10, etc., or vice versa, but turning it directly from figure 1 back to figure 200 will damage the shutter. The small wheel on the left side of the shutter housing has the markings "T," "B," "I," which have the respective meanings of Time, Bulb and Instantaneous exposures. This shutter may also have the letters "Z," "D," "M" which are the abbreviations for German equivalents of the above. When set at "T" and "B" this shutter is operated by pressure on the release lever or the cable release as follows:

When set at "T" pressure on the lever or cable release will open the shutter leaves; another pressure will close the shutter leaves. When set at "B," pressure on release will open the shutter leaves, relieving the pressure will cause the leaves to close. When set at "I," shutter mechanism must be cocked by



9. **FRONT SHUTTER,** also known as the "between-the-lens" shutter. The type shown here is the new Press-Compur shutter. It is of the Rim-setting variety, with shutter speeds of Time, Bulb and instantaneous exposures up to 1/200 second. The large Cocking Lever in this shutter allows opening of shutter for ground glass focussing without the necessity of resetting shutter speeds.

pulling down the setting lever. This lever should not be drawn down when the dial is set to "B" or "T", or their respective German equivalents, since to do so would damage the shutter.

Rim-set Compur Shutter

The speeds of this shutter are controlled by a knurled nickel ring revolving around the outside of the shutter housing and it is frequently referred to as a Rim-Set type Compur shutter.

Some models are known as the Compur-Rapid type of shutter, having shutter speeds as high as 1/400 second. The designations of "T" and "B" are the same as on the Dial-set Compur shutter. The marking of the instantaneous exposure "I" is omitted. When the index mark points to figures on the knurled ring, the shutter is set for instantaneous exposures, the figures representing the fractional parts of a second for which the shutter leaves will remain open. When figures on the rim are opposite the pointer, the shutter mechanism must be cocked by pressing the setting lever to the right. Pressure upon the shutter release either directly upon the release lever or through a cable release will make the shutter open and close.

The control ring should not be turned from 1/100 of a second to the higher speed after the shutter had been cocked. It is best practice always to set the rim before cocking the lever. The cocking lever should never be set when the rim is arranged for Time or Bulb exposures.

A "delayed action" of approximately 10 seconds in the action of the shutter will be produced automatically if, after the shutter is set and cocked, a small button behind the cocking lever is moved back and this lever is pushed further to the right. Releasing the shutter will activate the delay mechanism. After some 10 seconds' delay the shutter itself will operate and produce the exposure. The delayed action mechanism must not be used with the highest shutter speed.

Press-Compur Shutter

This new type shutter outwardly resembles the familiar rim-operated type. It is fitted with a more readily operated diaphragm lever and large shutter cocking lever. These two features have been incorporated into this shutter to adapt it better for press and synchro-flash photography—hence its name.

In addition to these two features, the "delayed action" mechanism has been eliminated entirely from this new type shutter. The space formerly occupied by it has been given over to a mechanism which is of particular interest to photographers using the Graphic camera for synchroflash photography. It permits the shutter to be opened for ground glass focusing through the lens without flashing the bulb. This feature of the new shutter works as follows: the shutter is pre-set as usual by turning the rim to the required shutter speed. It is then cocked by means of the large "cocking lever," which sets it ready for the flash exposure. If it is desired, however, to open the lens now for focusing upon the ground glass, this can be done by pushing back the button that formerly controlled the "delayed action" mechanism, and, at the same time, tripping the regular shutter release. A built-in catch will stop and hold the leaves of the shutter in their "open" position. After focusing the shutter is re-cocked, which disengages the catch automatically, and sets the shutter ready for the exposure in the usual manner. If a picture is not to be made, the catch may be released manually, whereupon the shutter will close. This catch is spring-actuated and cannot be set accidentally; consequently it will in no way affect the normal operation of the shutter.

This desirable feature is available in the following lenses: the 101mm (4 inch) Kodak Ektar f/4.5 and the 127mm (5 inch) Kodak Ektar f/4.7, both of which can be had in the Supermatic shutter with Press-Focus Button. Also in the 135mm (5¼ inch) Carl Zeiss f/4.5 in the Press Compur shutter.

Lenses mounted in "between-the-lens" shutters are equipped with an iris diaphragm which is located between the front and rear lens elements. The leaves of the iris diaphragm can be moved to form circular openings of different diameters, by moving the aperture pointer (Figure 9). The iris diaphragm is similar in name, appearance, and function to the iris of the human eye. Another function performed by the diaphragm is that of controlling the depth of field. More information on this subject appears in the chapter "How to Choose Your Lens" elsewhere in this volume.

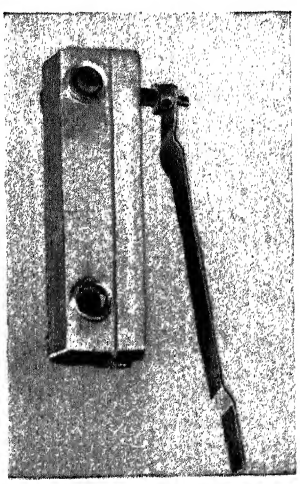
Range Finder

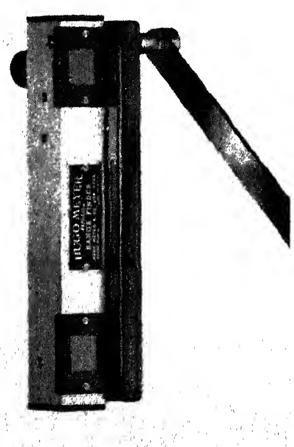
Probably the most important single development affecting the operation of the Speed Graphic was the availability of the internally coupled range finder, sup-

plied as an accessory. The use of the range finder and parallax corrected view finder on a Speed Graphic has made its operation not only easier, quicker, and more effective, but probably became responsible for more prizewinning pictures than any other feature of the camera.

To use a range finder, the operator looks at the subject through the aperture in the back of the finder. (An untrained eye will find it easier if the range finder is equipped with an eye-tube extension which is threaded into the encircling bracket available as an accessory). The eye will see the image of the field, and in the center of this a small circle showing possibly another part of the field viewed. As the knurled focusing pinion on the camera bed is turned, moving the lens forward or backward, this small image will move up or down. When the two images, the small and the large one, coincide and become one, the lens will be in sharp focus on that subject. As the lens standard moves with the track, the coupling of the range finder transmits this movement to its mechanism. This makes it possible to make a range finder function without any other motion except that required for normal operation of the lens standard.

The rangefinder has become such an important accessory part of the Speed Graphic camera that illustrations of the two available and recommended instruments properly belong here.





10. RANGEFINDERS: Internally linked to front standards of Speed Graphics, a rangefinder provides quick and dependable means for securing sharp focus. Shown are the latest models of these instruments of Kalart (*left*) and Hugo Meyer (*right*) available for various sizes of the Speed Graphic cameras.

The Kalart internally coupled rangefinder is available for the various models and sizes of Speed Graphics. Illustrated is the latest model E.

The Hugo Meyer Rangefinder with its rubber extension eyepiece is also shown here in its latest currently available version.

When properly installed and handled these instruments will serve indefinitely for the purpose of securing quickly and consistently sharp pictures. Their operating range extends from 2 or 3 feet to infinity. It is important to realize that rangefinders are precision instruments and that being "coupled" to a given lens they cannot be expected to perform equally well with another lens even of the same make or focal length because of the individual characteristics of every piece of fine optics. Because some cameras and lenses must be equipped with rangefinders at the Graflex plant, while others may be fitted with these instruments locally or at the plants of the respective rangefinder manufacturers—it is invariably best to consult your Graflex dealer on the proper procedure. Each instrument or camera equipped with one is accompanied by a manual containing detailed directions for its handling. Compliance with these recommendations will assure consistency of good results.

The Graflex Flash Synchronizer

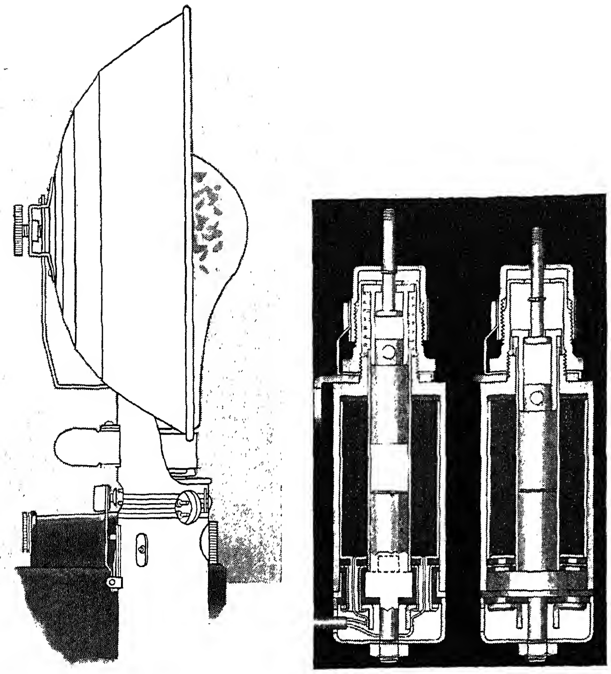
The Graflex Flash Synchronizer, engineered and built by Graflex especially for use with Speed Graphics (though intended also for use with the Super D Graflex cameras) particularly in connection with their modern between-the-lens shutters, operates upon basic electro-mechanical principles of considerable importance for constantly efficient operation, even under conditions of low battery output. It consists of three units: (1) An electro-magnetic Solenoid Release (shutter tripper), (2) Battery Case, and (3) a Reflector. For operation with front shutters, all three units are required. For use with the built-in focal plane synchronizer, such as are available in the 2¼ x 3¼ Miniature Speed Graphic and the Super D Graflex—only the battery case and the reflector units are needed.

The release, which actuates the shutter, works on the inertia principle and is built around a solenoid of comparatively high resistance. The solenoid release is so compactly built that it can remain permanently fastened to the lens boards of the 3¼ x 4¼ and the 4 x 5 Anniversary Speed Graphics. Only the slender connecting cable need be detached for closing the camera. For other models of the Speed Graphic a special mount is supplied from which the solenoid release is instantly detachable without impairing its functional adjustment.

The battery case is available in two sizes: One for two battery cells, the other for three cells. Each battery case has three outlets, to one of which the solenoid release cord is connected, while the other two are used for extension cords required for multiple-flash work. One of these outlets accepts standard Graphic connecting cords, while the others accept standard household plugs, such as are found in portable reflector units, floor and table lamps, etc. In addition a *series connection* is provided for focal-plane connecting cord for use of the battery case and reflector units with the Super D Graflex and with those Speed Graphics that are equipped with a built-in focal-plane synchronizer circuit and socket. This connection is also available for remote control flashing. It further has a safety device which prevents flashing the lamps with the battery case switch when the focal plane connection or extension switch is plugged in.

Another useful feature of the battery case is its built-in focusing spot-light which provides illumination for focusing, viewing and centering pictures taken in poor light. This spot-light also serves as a battery-strength indicator. A clamp operated by a lever serves to fasten the case firmly to the camera bracket or to the range-finder encircling bracket.

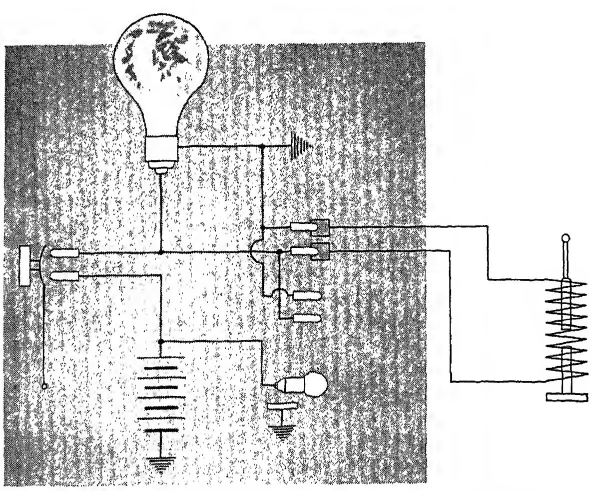
One of two types of reflectors is furnished with the Graflex Flash Synchronizer. The first is a 7-inch reflector for standard size, medium-base flash lamps. This reflector spreads the light evenly over a 120° field. The second type is a 5-inch



10a. GRAFLEX FLASH SYNCHRONIZER (*left*): Side view of Reflector and top of Battery Case showing important operating controls: Main Switch with its silver contacts, the parallel outlet, lamp socket grips, focusing spotlight, etc. (*right*): Cross-section of the finely balanced inertia-type Solenoid Release.

(G. E. Design B) concentrating reflector for the midget bayonet base flash lamps which concentrate the light emitted by these lamps within a 60° field. Both of these reflectors are of the self-centering type and are equipped with ejectors which obviate the handling of hot or broken lamps.

The construction and arrangement of the Graflex solenoid release is shown diagrammatically in the accompanying illustration (Figure 10a). The electric circuit of the unit is shown in Figure 10b. It is worth noting that the comparatively high resistance of the inertia type solenoid release combined with the low resistance of the incidental electric circuit and careful balancing of mechanical elements of Graflex Flash Synchronizer are responsible for the maintenance of correct synchronization even with batteries having ampère capacity as low as 3. The careful design of the circuit is reflected in the unit having been provided with silver contacts in the main flashing switch. Low current output caused by low temperatures, aging or excessive use of batteries will not impair the ability of the unit to synchronize the flash until the current output drops to the point at which the flash lamp would not ignite.



10b. GRAFLEX FLASH SYNCHRONIZER CIRCUIT shown diagrammatically, revealing flow of current through various operating parts.

Flash Synchronization

The Speed Graphic is used for synchronized flash photography by newspaper men and professional and amateur photographers to a great extent. It is because it is so well adaptable to this type of work. The reader is referred to the chapter on Synchroflash Photography for more detailed information on this phase of photography with a Speed Graphic. Let it be said here only that every Speed Graphic camera can be used for synchroflash photography with suitable equipment for front shutter synchronization.

5 x 7 Speed Graphic

This is a large camera yielding negatives 5 x 7 inches in size. It is particularly used for commercial, industrial, and color photography where large negative sizes are desired. Its bellows extending up to 16 inches, with the lensboard of 4 inches square, it can be used with many lenses of various focal lengths. It has 24 focal plane shutter speeds ranging from 1/10 to 1/1000 second and "time." It is supplied either with the Graphic back using Century Riteway Film Holders, and the Kodak film pack adapter, or with the Graflex back, in connection with which all Graflex film and plate accessories can be used.

4 x 5 Speed Graphic

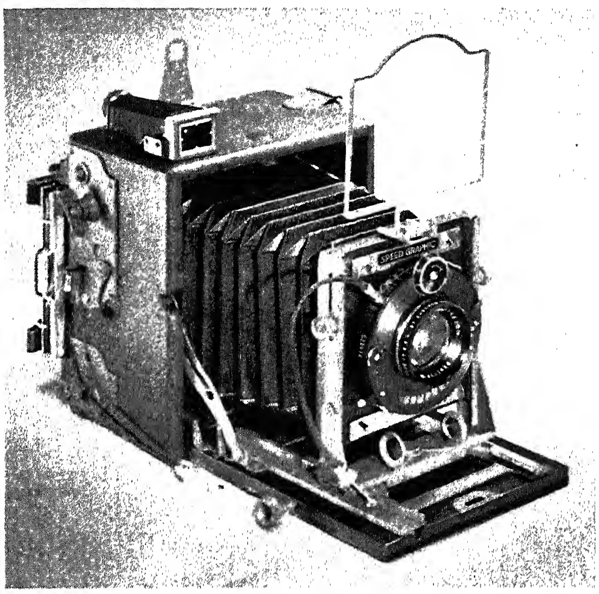
This is a favorite press cameraman's size, because the negative of 4 x 5 inches is of an ideal proportion as far as most standard page sizes of publications are concerned. For quick newspaper work, negatives of this size need not be enlarged. Whenever 8 x 10 enlargements are required, 2x magnification will produce excellent prints with minimum loss of detail.

This camera has a bellows draw limit of 13½ inches and a lensboard of 4 inches square. A great variety of lenses is available for this Speed Graphic range from the accessory wide angle 3½-inch lens up to the 17-inch telephoto lens. Its standard equipment is a regular focal plane shutter, and it is available with either the Graphic or Graflex backs.

$3\frac{1}{4} \times 4\frac{1}{4}$ Speed Graphic

This camera is also very popular with press photographers especially with those specializing in "feature" work and "class magazine" work employing high finish paper stock for their reproductions. It is a popular camera for color photography with Kodachrome film, due to its ability to turn out excellent color work economically. It is also used for photomicrography, and it is a favorite with advanced amateurs.

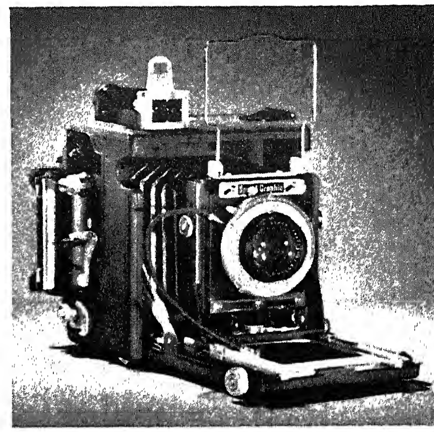
Its bellows capacity is 12 inches, its lensboard measuring $3\frac{1}{4}$ inches square. Standard features are the focal plane shutters, and they are available with either Graphic or Graflex backs.



11. SPEED GRAPHIC CAMERA. This is the older model of Speed Graphic identical, except size, for the $3\frac{1}{4} \times 4\frac{1}{4}$, 4 x 5, and 5 x 7 units.

Miniature Speed Graphic $2\frac{1}{4} \times 3\frac{1}{4}$

This recent addition to the Speed Graphic family has become one of the most popular folding hand cameras. Small and compact, it has many unique features which appeal to the serious amateurs and professionals as well. It has a bellows capacity of 9 inches, and a lensboard measuring $2\frac{1}{2}$ inches square. It has a built-in focal plane shutter, flash synchronization, the first camera of this kind to offer this feature. With it, focal plane synchronization is possible at shutter speeds ranging from 1/60 to 1/1000 second! Although front shutter synchronization with this camera is practical with the aid of many commercially available synchronizing outfits, the availability of the focal plane built-in flash synchronizer permits the making of such photographs with a mere battery holder and reflector.



12. MINIATURE SPEED GRAPHIC. This is the smallest model of the Speed Graphic family, producing negatives $2\frac{1}{4} \times 3\frac{1}{4}$, either on cut film or film packs.

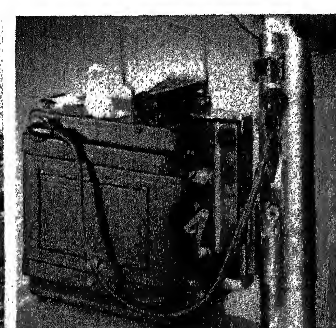
This camera is thoroughly modern and streamlined, and among its notable features is a metal bed, "helical gear" movement for its sliding track, which can be conveniently operated from either side of the camera. In addition to many fine lenses available for this camera, a notable piece of optics can be had for it: the 101mm (4 inch) Kodak Ektar f/4.5 in the Supermatic shutter with the Press-Focus shutter button with a range of exposures from 1 to 1/400 of a second, plus time and bulb exposure. This lens is well corrected and especially suited to the requirements of color photography.

Like other Speed Graphics the Miniature Speed Graphic is supplied with either the Graphic or the Graflex backs.

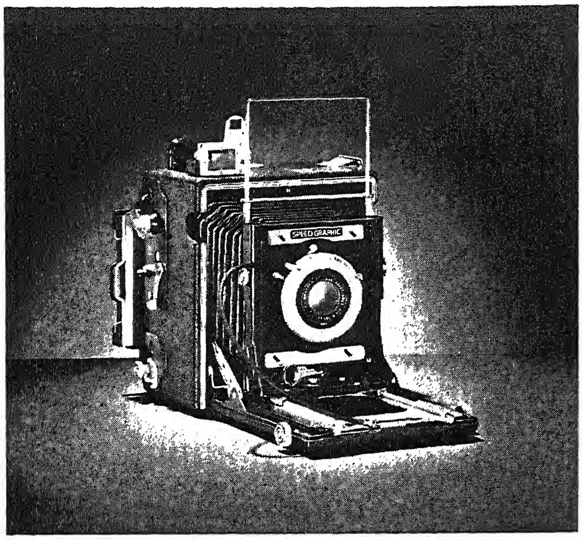
New Speed Graphic Models

The Anniversary Speed Graphics, as they are designated, appeared early in 1940 embodying a number of

13. SYNCHROFLASH CABLE CONNECTION (detachable). Built into back of Miniature Speed Graphic. The Cable connects to the series outlet of the Graflex Flashing Unit.



14. OPERATOR'S VIEW of Miniature Speed Graphic: with cable release, range finder, battery case with reflector, connected to camera, ready for action.



15. ANNIVERSARY MODEL SPEED GRAPHIC. Available in either $3\frac{1}{4} \times 4\frac{1}{4}$, 4 x 5 or 5 x 7. Featured innovations described in text.

refinements and improved features which greatly extend their usefulness and convenience of operation. Their design has been greatly influenced by the experience the manufacturers had with the Miniature Speed Graphic. Several of the interesting features of the new Anniversary Speed Graphic are shown in figures 15 to 19. They are available in $3\frac{1}{4} \times 4\frac{1}{4}$ and 4 x 5 sizes.

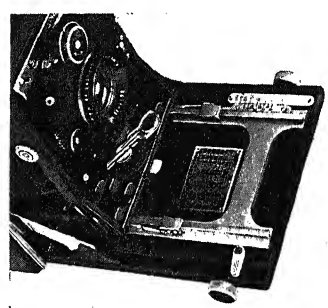
The most obvious changes were incorporated into the track, front standard, and front standard lock, resulting in greatly increased rigidity of these important parts of the camera.

In place of the two finger grips that formerly locked the standard in position on the track, there is now a new and more positive lock and grip. When the wing-like grip is centered, the standard moves freely on the track; pushing the grip to one side forces broad metal plates against the track to lock the standard firmly against all movement or play.

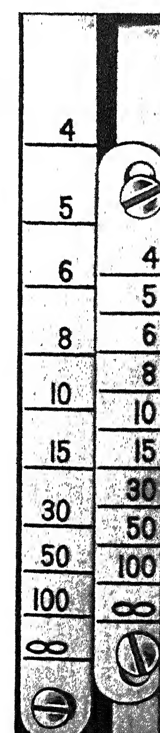
Lateral shift for the front standard is new; it permits raising the lens to photograph higher buildings with the camera used vertically. When the lock-grip is unlocked and the catch depressed, the standard may be shifted as needed, and then locked in any position with the grip.

Aside from the new durable chromium finish the sliding track has received the most significant improvement. It was transformed into a feature which may be called the "tandem track." The sections of the track in the body and on the bed are closer together and are linked so that both move together when the lens is focused by means of the focusing knob. The front standard slides much more easily into infinity position, and a new type of infinity stop assures its maintaining that setting. The infinity stops have been provided with special retaining springs. Also new is a special track lock to prevent accidental disturbance of the focus. Incidentally, the new models have now a second focusing knob on the left side of the camera bed. This feature permits focusing of the camera to be done with either hand. A smoother performance of the rack-and-pinion movement of the sliding track has been secured by the helical gear construction of its parts.

The linking of the two parts of the sliding track, which is conveniently referred to here as the "tandem track," is of special significance in connection with the

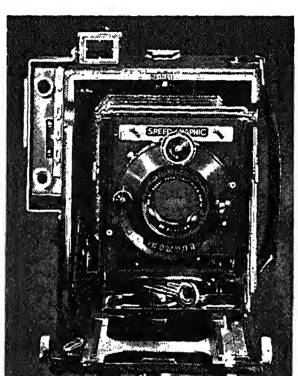


18. ANNIVERSARY SPEED GRAPHIC. Showing new metal bed, new style infinity stops, new positive front standard lock, new position for template indicating focal plane shutter speed, and vernier-type focusing scale. Also double focusing pinions with helical gear type movement.



19. VERNIER-TYPE FOCUSING SCALE. Available on Anniversary Speed Graphics and on Miniature Speed Graphics. When lines of same numbers are opposite each other, camera is focused for that distance. Illustration shows focus on 15 feet.

16. ANNIVERSARY SPEED GRAPHIC showing "tandem track," dropped bed for wide angle lens use. Note suspension on side arms.



17. ANNIVERSARY SPEED GRAPHIC showing rising front, lateral shift and positive front standard lock.

improvement made to the supporting arms of the camera bed. In former models the supporting arms had to be disconnected and the bed dropped to get it out of the field of the wide-angle accessory lens. In addition, an accessory wide-angle bed had to be inserted to take care of the extension necessary for focusing. Because of the short focal length of the wide-angle lenses they have to remain pretty close to the focal plane of the camera. This results in the front standard remaining mostly on the rear portion of the track and often entirely within the body of the camera. As that part of the track was fixed in the former models of the Graphic, the lens had to be focused manually, which was both inconvenient and not sufficiently accurate. In the Anniversary Graphics when the bed is dropped the side supports remain connected to the guide pins in the sides of the camera body so that the bed continues to receive its firm support. The linked track permits critical focusing of wide angle lenses by means of either of the two focusing pinions. A great convenience, indeed!

The new, heavy duty, all-metal front lens standard represents also a desirable improvement. It provides greater rigidity as in its function as a lens support. The wire frame, which was formerly attached to the wooden top of the lens standard is now ingeniously recessed within the metal frame of the lens standard, from which it is extended upward for use, and into which it is completely retractable, disappearing out of sight when not needed. Its chromium finish not only adds to its appearance, but increases its utility: its visibility is greater in poor light.

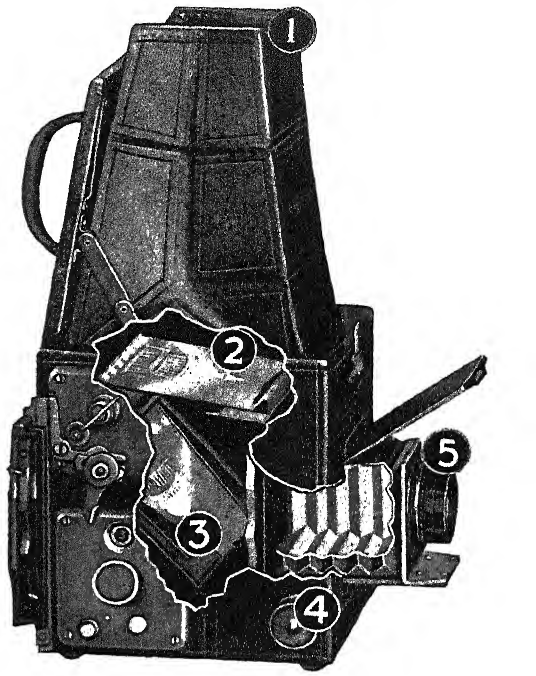
The linking of the rear portion of the track with the front makes possible a simplified and more reliable range finder coupling. The connecting arm contacts directly with a stud on the track without intermediate links, thus eliminating the chances for play and wear existing with the previously employed, more complicated lever-and-spring system. Also, the fact that when the camera bed is dropped for wide angle work, it continues to be supported by the side arms, is a good safeguard for cameras equipped with internally coupled range finders: there is less danger for the range finder connections to get bent or strained by the dangling camera bed and the loose side supports.

The last, but not least, improvement made upon these new models is the focal plane shutter lock which will be found in the form of a small bright button next to the exposure lever. When this small button is moved slightly towards the back of the camera, the exposure tripping lever cannot be moved. The danger of accidental or unauthorized operation of the focal plane shutter is greatly lessened.

All new models of these Speed Graphics have the new tubular view finder with parallax adjustment furnished as standard equipment, superseding the familiar Graphic sight finder.

The anniversary Speed Graphics have been made to look more like their little brother, the Miniature Speed Graphic through their attractive satin and polished chromium trim.

. . . which brings us to the Graflex camera.

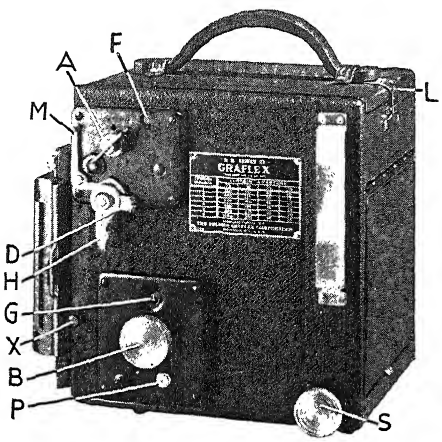


20. GRAFLEX MIRROR REFLEX FOCUSING PRINCIPLE: 1. Self-erecting focusing hood; 2. Ground glass receiving image from mirror (3), which intercepts image formed by lens (5); 4. Knurled focusing pinion, turning of which racks lens back and forth for focusing. When image appears sharp upon ground glass, it will be sharp in the focal plane, as mirror will swing out of way for exposure.

Graflex Camera

The principle of the Graflex camera is extremely simple, which accounts for the ease and efficiency of its operation. Outwardly, when closed, the Graflex more nearly resembles a neat cube than any other camera. Built substantially from seasoned, mitered Honduras mahogany, covered with black leather throughout, reinforced internally by metal angles and braces, the Graflex camera, regardless of its size, is extremely rugged, solid, and, considering the solid materials of which it is made, is very light.

The Graflex camera is built around the principle of a reflecting mirror, which, when in focusing position, intercepts the image formed by the lens, and reflects it upwards. The reflected image appears right side up, same size as it will appear on the negative. Not only is the size of the image identical, but its other characteristics, such as sharpness, depth of field, visual luminosity, etc., are also the same as those which will appear in the negative. The mirroring surface of the Graflex reflecting mirror consists a highly polished coating of a chrome aluminum compound, which is applied to the front surface of the glass. This is a significant feature because it prevents objectionable and confusing second-



21. GRAFLEX OPERATING CONTROLS. For explanation of various controls, see text.

ary reflections, particularly disturbing in poor light. These reflections usually originate in mirrors silvered in back. Also, a reflecting mirror coated on the front is capable of reflecting more light than one plated on the back.

When the image appears to be clear and sharply focused upon the ground glass it will appear just as sharp and clear upon the negative. The reflecting mirror, which intercepts the image formed by the lens throughout the entire period of focusing, is made to swing upwards for the exposure. At the very instant when the mirror is swung out of the way, the Graflex focal plane shutter starts on its way across the plane of the film, thus producing the exposure. This is the basic principle of the operation of each Graflex camera, of which there are now five models available (including the National Graflex), producing negatives which range in size from 2⅛ x 2¼ to 5 x 7 inches.

Probably the most characteristic and most familiar aspect of every Graflex camera is its collapsible, self-erecting focusing hood. When the camera is closed it remains concealed, neatly folded under its top. When the top is opened, by the convenient leather handle, it rises into its working position. To raise the cover a small spring catch is pressed; to secure the erected position of the hood two small side arms are pressed down (or up, depending upon the model). This will hold the hood taut and will keep out all extraneous light, eliminating its tendency to interfere with critical focusing.

The operation of the Graflex camera is similar to that of the Speed Graphic. Since, however, a reflecting mirror is a part of its mechanism, the operating controls of the Graflex are somewhat different from those of the Speed Graphic. Except for the release lever, which is located on the forward, left hand side of the camera body, all controls of the Graflex are conveniently grouped on the right side of the camera body, as shown in figure 21.

To operate the camera after opening its top—raise the cover which will extend its focusing hood upwards. Secure its position by pressing the small side arms which connect the top of the camera to its main body. When the lens is racked out into focus with the focusing pinion (S) the front door of the camera will raise itself, allowing the lens to extend beyond the body of the camera, and producing an effective lens hood of the front camera cover. In the case of the Revolving Back Auto Graflex the camera is opened by pressing a release button. The front of the camera then swings out and forms a camera bed upon which the lens standard moves on a sliding track.

The reflecting mirror is locked in its focusing position by pressing the lever (H) as far as it will go. A sliding bar (D) is moved to the left which will expose (I) upon its end indicating setting for an instantaneous exposure. This movement will conceal the (T) at the other end which, when visible, indicates that the shutter is set for a time exposure. With (I) exposed, the shutter curtain, which in all other aspects is identical to that described in the Speed Graphic camera, is wound by turning the key (A) counter clockwise until the required aperture number will appear at (F). If the curtain is already set at a smaller aperture than required, pressing the lever (M) towards the rear of the camera will make the desired curtain aperture to appear at (F). This lever may have to be pressed a few times as a change in the curtain aperture occurs by one step for each pressure upon the lever. The curtain mechanism is so designed that it is impossible to rewind the curtain when the mirror is not in the focusing position. This arrangement prevents fogging of film, as it makes it necessary to set the mirror in the focusing position before rewinding the shutter curtain. Incidentally, it should be noted that the mirror, when set to the focusing position, covers the entire film chamber completely. It is light-tight. This permits withdrawal of the film slide from the film holder, and, unlike in the Speed Graphic, the rewinding of the curtain without the dark slide being in the "covered" position.

Tension of the curtain is regulated identically as it was described for the Speed Graphic by turning the milled knob clockwise until the required tension number appears in window (G). Should the tension number be set for a higher number than required, the tension of the spring is released by moving the sliding escapement sideways or up and down, depending upon the model, until the desired tension number appears in (G). It will be noted that the various shutter speeds obtainable from the different tension number and curtain aperture combinations are indicated on the shutter speed plate conveniently attached to the control side of the Graflex camera.

Instantaneous Exposures

After setting the shutter and properly focusing the image upon the ground glass the exposure is made by gentle downward pressure of the release lever, located on the forward left-hand side of the camera body. It is most important to develop through practice a downward movement of the release lever, which will produce a smooth, even action. It should be likened to a "trigger squeeze" probably best accomplished by pressing the lever with the thumb, and, at the same time, counterbalancing that pressure with an equal upward pressure of the forefinger against the bottom of the camera. This will most effectively prevent camera movement and the resulting blurred images. Another effective method to insure steadiness of the camera is to hold it firmly but without much effort with elbows pressed against one's sides. Holding the top of the hood against the chin will help too.

Pressure of the lever on the left releases the mirror, which swings upwards and, almost simultaneously, starts the focal plane shutter.

In the Super D Graflex, this brings into action the Automatic Diaphragm Control. Movement of the release lever on the camera is transmitted to a catch, which releases the diaphragm lever so the latter can turn to an aperture which was pre-set in accordance with the exposure desired. In this camera, the mirror also carries a pair of contacts which close the circuit firing a flash lamp at the proper time: just before the shutter starts to close. This special built-in flash synchronizer operates only at the 1/5-second exposure. While the slowest stated exposure of the focal plane shutter is 1/10 of a second, it is possible to make slow instantaneous exposure of about 1/5 of a second with the curtain set at (O—open) and the tension spring set to No. 1. Pressure upon the shutter release lever will cause the mirror to rise just before the curtain drops to close.

Time Exposures with the Graflex

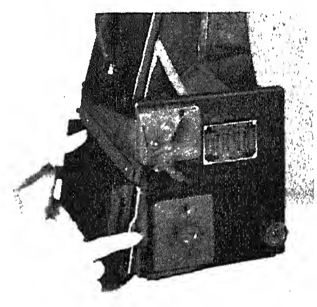
With the lever (H) pressed down and the sliding bar (D) pushed in toward the front of the camera, exposing T, the camera is set for a time exposure. The curtain is wound until T appears at (F). After the image had been focused, the mirror is released by pressure upon the exposure lever on the left-hand side of the camera body, and the shutter is opened by a gentle backward pressure on the lever (M). When the required time has elapsed the second pressure on the lever (M) will close the shutter. For long exposures, where fractions of a second are of little significance, the spring tension for time exposure may be set to No. 1. For brief exposures of 1, 2 or 3 seconds, it is best to set the spring tension to No. 3 to secure quicker response to the pressure on the lever (M). Also it should be remembered that the lever (M) should be handled by its extreme tip, touching it in a manner which will prevent the winding key (A) from being stopped in its rotating movement by meeting the finger in its way.

Caution: When the shutter is set for time exposure the curtain can be rewound without setting the mirror. So be sure to set this or replace the slide in the holder.

Vertical and Horizontal Pictures

Except for the 5 x 7 Series B Graflex and the National Graflex, all other current Graflex models are equipped with the ingenious and most useful revolving back feature, which permits the taking of either vertical or horizontal pictures, or, for that matter, any intermediate setting with the camera remaining in its normal position. The change-over from horizontal to vertical or vice versa is effected without danger of fogging the plate or film, even with the dark slide withdrawn from the film holder, since the revolving back feature is completely light proof.

To make the change-over, simply depress the button (X) and revolve the back to any desired setting.



22. GRAFLEX REVOLVING BACK, showing simplicity of change-over from horizontal to vertical picture.

Direct focusing on ground glass. It is frequently desired to focus upon the ground glass directly instead of focusing through the reflecting mirror. The Graflex can be used as a view camera, if desired. To accomplish this, the focusing hood can be returned to its folded position by closing the top cover of the camera, and, with the slide bar (D) set to expose letter T, the reflecting mirror is swung out of the way by pressure upon the release lever located on the forward left hand side of the camera body. The curtain is set to O. The image can then be focused upon the ground glass of the accessory focusing panel just as a Speed Graphic or a view camera would be used.

The Graflex camera is available in a variety of models and sizes, which are all built around the same basic principle. With great similarity in their handling and operation, they serve different purposes, and vary in refinements, and special features.

The National Graflex

The smallest and most compact of all Graflex cameras is the National Graflex. Because it is so small that

23. **NATIONAL GRAFLEX** shown with accessory 140mm B & L f/6.3 telephoto lens.

it will not extend beyond the area offered by an open hand, its shape is different from that of a conventional Graflex camera. It is a very popular and efficient miniature camera producing pictures on negatives measuring 2⅛ x 2¼ inches, indeed a large size negative for such a small camera. Equipped with a 75mm (3 inch) Bausch & Lomb f/3.5 Tessar lens in a helical, micro-focusing mount, it has the Graflex focal plane shutter with speeds up to 1/500 second. The camera has the self-erecting top, the built-in exposure guide, and the Graflex full vision ground glass focusing features. An accessory 140mm Bausch & Lomb f/6.3 Telephoto lens is available for the National Graflex, extending its usefulness considerably because of the ready interchangeability with the standard lens. The telephoto lens almost doubles the image size of the subject as compared with the standard optical equipment of the camera.

The operation of the National Graflex is quite similar to that of the standard Graflex camera and it differs only in that the controls of the individual parts are placed all on top of the camera instead of the side of the camera body. The National Graflex appeals especially to people doing much of sports and candid photography as well as pictorial work where high quality enlargements are desired.

In addition to standard accessories available for the National Graflex such as a line of filters, copying attachments and diffusion discs, several special attachments are available for this camera which greatly extend its usefulness. To mention just a few, there is available for it a direct view finder for eye level photography, a microscope adapter, etc.

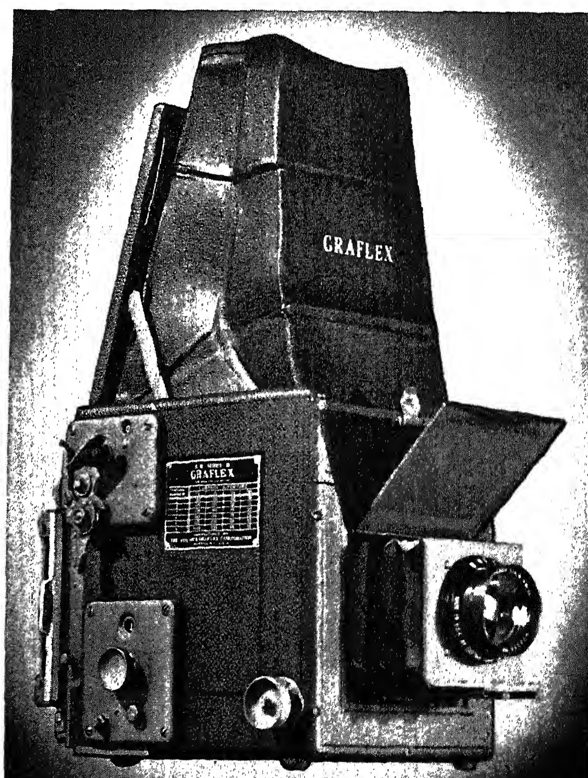
Series B Graflex

This model of the Graflex camera is the least expensive and has wide favor with amateurs, advanced workers and professionals who use it for portraiture, candid camera work, pictorial and general photography. It is available in four sizes, 2¼ x 3¼, 3¼ x 4¼, 4 x 5, 5 x 7. The first three sizes are available with revolving backs permitting horizontal and vertical pictures. The largest size, 5 x 7, is available with stationary back only. A stationary back is fixed for horizontal pictures. All models of the Series B Graflex have the full vision ground glass mirror reflex focusing and the focal plane shutter. Its Graflex back is available for using sheet film, film packs, roll film or plates. Standard equipment, as furnished by the factory, is Kodak Anastigmat f/4.5 lens, individually fitted at the factory. Accessory telephoto lenses ranging from 11 inches focal length for the 2¼ x 3¼ Graflex to 15 inches for the 4 x 5 Graflex, or 17 inches for the 5 x 7 size, are available.

Each of the Series B Graflex cameras is provided with the Graflex self-erecting focusing hood. The all-metal front is threaded to take the standard lens as well as accessory lenses listed for these respective models.

The 2¼ x 3¼ model has a bellows capacity of 7-3/16 inches. The standard focal length of its f/4.5 Kodak Anastigmat lens is 5½ inches. The closest working distance with this lens is 21 inches.

The 3¼ x 4¼ model has a bellows draw capacity of 8-7/16 inches. With its f/4.5 Kodak Anastigmat lens of 6⅜ inches focal length, the closest working distance is 23 inches.



24. **GRAFLEX SERIES B WITH REVOLVING BACK.** Front cover swings up when lens is racked out by means of focusing pinion.

The 4 x 5 model has a bellows capacity of 10⅛ inches. The f/4.5 Kodak Anastigmat lens has a focal length of 7½ inches, producing the closest working distance of 27 inches.

The 5 x 7 camera has a bellows capacity of 11 inches and with its f/4.5 Kodak Anastigmat lens of 8½ inches focal length, it permits closest working distance of 29 inches. This model camera is provided with a stationary back only, fixed for horizontal pictures.

All Series B cameras are equipped with focal plane shutters yielding instantaneous exposures ranging from 1/5 second to 1/1000 second and time exposure.

Series D Graflex

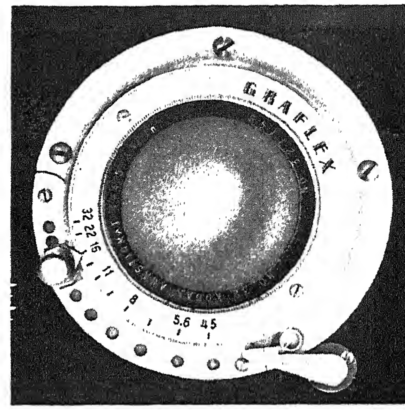
This model camera, available in two sizes: 3¼ x 4¼ and 4 x 5 is made in the revolving back type only. It definitely represents a camera for the more advanced worker both amateur and professional, who can afford better type of equipment. While intrinsically identical with other Graflex cameras in its operation, the Series D has a number of significant refinements which not only improve its appearance but add greatly to its usefulness and versatility. The interchangeable lensboard on this model allows the use of wider range of accessory lenses and provides easy and quick interchangeability. Some seventeen standard focal length lenses are available for this model of the Graflex camera ranging in speed from f/2.9 to f/4.5 and focal length from 6 inches up to 12½ inches. This model accommodates large lensboards. It is possible to employ with it large aperture high speed lenses.

The self erecting focusing hood of this model is provided with a furry silk chenille band which allows closer approach of the face to the edge of the hood. The front lens standard is supported by an extremely rigid metal frame which forms a double, metal track operating on a pinion. This feature, coupled with the generous full size durable bellows and a spring-activated lens hood with side screens, results in a very solid and vibrationless performance.

The 3¼ x 4¼ Series D Graflex has a bellows capacity of 8¼ inches. The lensboard measures 3¼ inches square, and it accommodates the lens of a minimum focal length of 6 inches.

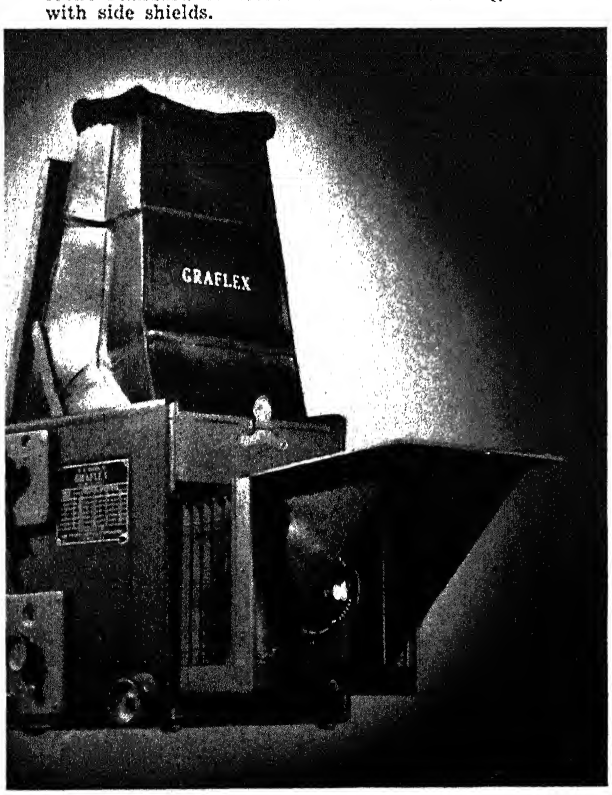
The 4 x 5 Series D Graflex has a bellows capacity of 12 inches fronted by a lensboard of 3¼ inches square. The minimum focal length accommodated in this camera is 7 inches.

Both sizes have the Graflex focal plane shutter with speeds ranging from 1/5 to 1/1000 second for instantaneous and time exposures. Both sizes have the revolving Graflex back which takes all Graflex accessories, such as focusing panel, sheet film holder, roll film holder, film pack adapters, etc.



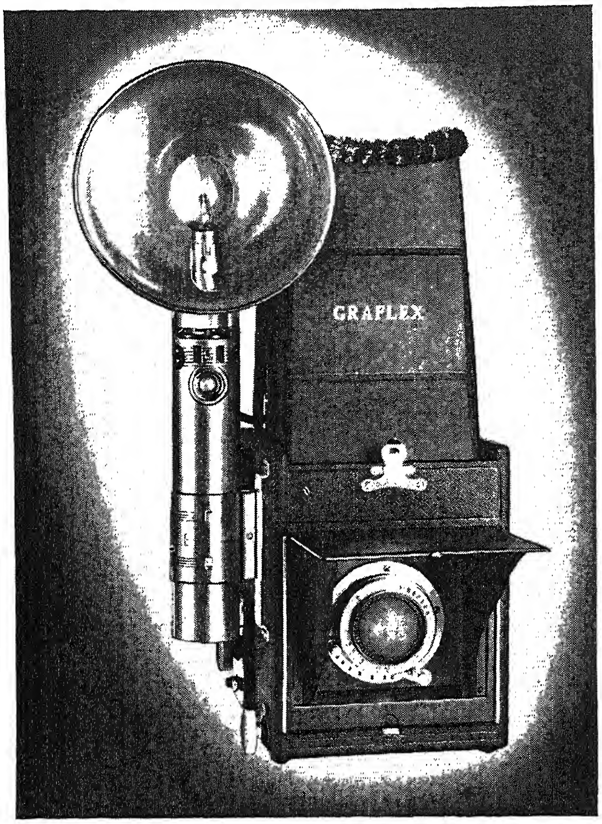
25a. AUTOMATIC DIAPHRAGM LENS MOUNT—available for the Super D Graflex—permits focusing with lens wide open and stops it down to the pre-selected aperture automatically when exposure lever is pressed.

25. GRAFLEX REVOLVING BACK SERIES D. Note front standard construction and self-erecting lens hood with side shields.



The Super D Graflex

The Super D Graflex camera, available at first in the 3¼ x 4¼ size, possesses all features of the Series D Graflex with the added provision for the use of Automatic Diaphragm Control and the built-in open-flash synchronization circuit. The Automatic Diaphragm Control is the name given to an ingenious arrangement incorporated into the lens mount and linked with the release lever of the camera. It permits focusing with the lens wide open, and automatically stops the lens down to a pre-selected aperture as the exposure release



THE SUPER D GRAFLEX shown with the Graflex Flashing Unit and its lens in the Graflex Automatic Diaphragm mount.

lever is pressed. The synchronizing contacts, at drop-curtain setting of "Slit 0" and "Tension 1" may be used for open-flash photography with ordinary flash-lamps for "still" subjects, with the SM lamp for action subjects, and with the Kodatron Speedlite for ultra-speed photography.

The automatic diaphragm control is built around a special lens mount containing a coil spring mechanism to activate the diaphragm, and a collapsible rocker arm within the camera body controlled by the mirror release lever to activate the diaphragm at any extension of the bellows. Figure 25a shows the automatic diaphragm at full aperture, pre-set to close down to f/16. The stop-pin (appearing at left in the photograph) is set to the desired working aperture by lifting the handle, moving it to the desired setting, and dropping the handle into the proper hole at that point. As may be seen from the illustration, it may be set to all standard stops from f/4.5 to f/32, and at intermediate half-stops between f/5.6 and f/16.

The diaphragm lever is then moved to the right until it is caught and held by the catch (as shown in the illustration). Movement of the release lever on the camera is transmitted to the catch, which frees the diaphragm lever, permitting the diaphragm to close to the point pre-determined by the setting of the stop-pin. If it is desired to stop down the lens aperture before exposure, the diaphragm is released by partially depressing the exposure lever on the camera to a point just before that at which the mirror itself is released.

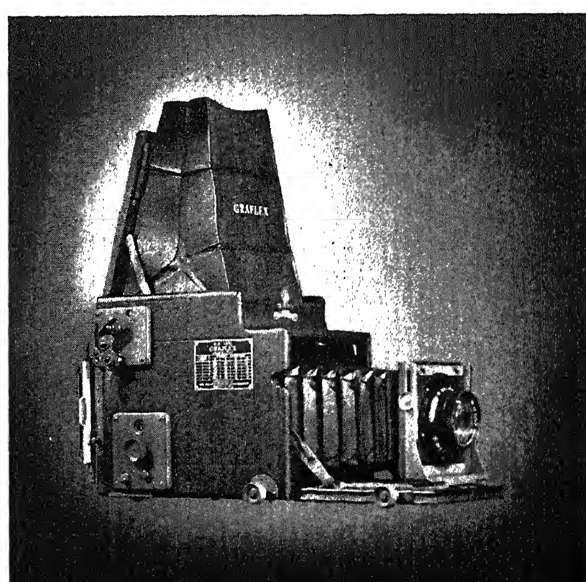
The diaphragm release linkage operates only on lenses equipped with the automatic diaphragm control mount, but does not interfere with the use of telephoto and other accessory lenses which do not have this feature. For this reason, the linkage is made standard equipment in all Super D Graflex cameras, regardless of the lens with which it is furnished. Initially, only the 6⅜ inch Kodak Anastigmat f/4.5 is available in the automatic diaphragm control mount.

The circuit of the built-in focal-plane, open-flash synchronizing feature is closed by a silver spring contact on the mirror. In use, the curtain is set at "0" and the tension at "1," and the mirror is dropped into its viewing position. When the dark slide is withdrawn from the negative holder, the camera is ready for the exposure as usual. A flash lamp (SM or other lamp depending upon whether the subject is moving or stationary) is inserted in the socket of the reflector and the exposure release lever is depressed. As the mirror rises, its contacts close the circuit, igniting the lamp just before the curtain begins to close, thus giving an "open-flash" exposure, the duration of which is determined by the flash lamp employed. Effectively, in the case of an SM lamp, this produces an instantaneous exposure of 1/200 second. The 2-cell Graflex battery case is used in connection with the 5-inch reflector, clamped to an attaching bracket on the right side of the camera. The connecting cord is inserted in the plug on the left side of the camera and its other end in the "*series*" outlet at the rear of the battery case.

Though the mechanical improvements incorporated in the Super D Graflex are simple and inconspicuous, their significance and usefulness are great. Elsewhere in this volume (see introduction to Torkel Korling's chapter on "Photography of Children") the significance and broad possibilities of work with a Super D Graflex are discussed at length.

Auto Graflex . . . With Revolving Back

This is a larger camera representing de luxe equipment intended for advanced amateurs, professionals,



26. AUTO GRAFLEX, REVOLVING BACK. Note auxiliary camera bed which permits front standard to be racked out to allow 1:1 ratio of reproduction. Note removable lensboard in rising front standard.
The R. B. Auto Graflex Camera is now available only in the 3¼ x 4¼ size.

laboratory technicians and salon exhibitors who feel that they are making a life-time investment in a camera combining the features of direct vision photography with many features available only in view cameras. In addition to other standard Graflex features such as mirror reflex focusing, focal plane shutter, revolving back, availability for use with practically all types of negative material, the Auto Graflex has a rising front and a bellows extension ample for 1:1 ratio reproduction work. This feature makes it a desirable camera for scientists, naturalists and photographers with similar exacting requirements. The lenses available for this camera range in focal length from 7 to 17 inches for the 3¼ x 4¼ size, and from 9 to 24 inches for the 4 x 5 size. A few of these lenses can be fitted to a Compur shutter, thus providing additional shutter speeds. The bellows draw capacity in the 3¼ x 4¼ model extends to 15½ inches, and in the 4 x 5 up to 18½ inches. The large size interchangeable lensboard makes it possible to use with the Auto Graflex camera the single element of convertible lenses for long range photography. The convertible Protar lens made by the Bausch & Lomb Optical Company shown in Figure 27 makes a particularly desirable acquisition for serious photographers because it offers the convenience of several lenses in one. This particular lens is a high quality optical medium with an opening of f/6.3. The convertible Protar lens is available in 7⅞ focal length for the 3¼ x 4¼ camera. The focal length of single element is 13⅞ inches. For the 4 x 5 camera this lens is available in 9⅜ inches focal length, which extends to 16⅜ inches for the focal length of the single element.

The Revolving Back Auto Graflex employs its front cover for an auxiliary camera bed, which is suspended by side arms in a manner similar to that employed in the Speed Graphic camera. This feature permits the use of the double extension bellows.

The 3¼ x 4¼ model with bellows capacity of 15½ inches and a lensboard measuring 3¼ inches square, accommodates a lens of minimum focal length of 7 inches.

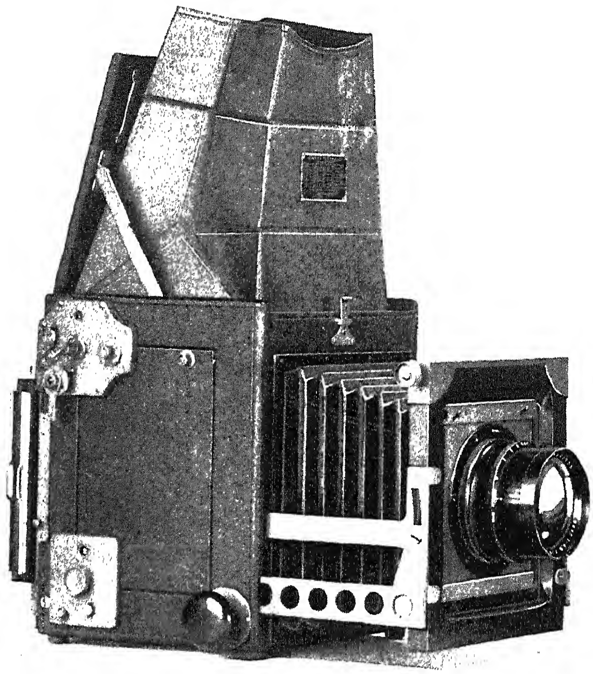
The 4 x 5 camera, the production of which has now been discontinued, has a bellows draw limit of 18½ inches and a lensboard of 3¾ inches square. This model accommodates a lens of minimum focal length of 9 inches.

Both sizes have the standard Graflex features of focal plane shutter with instantaneous speeds ranging in 25 steps from 1/5 to 1/1000 of a second, plus time exposures. Both cameras have the revolving Graflex back available for practically every type of negative material, from roll film to glass plates. Both cameras have the rising front and a focusing panel for ground glass work as standard equipment.

Home Portrait Graflex

This is definitely a professional camera — as its name implies — especially designed for the commercial and professional photographer specializing in producing fine portraits in the homes of his clients. It is used exten-sively for superior child portraiture. It is preferred by many to the view camera because of both its compactness and dignified appearance. It is much more rugged than a view camera. The reflecting mirror focusing feature which permits the operator to view the subject right side up is also considered an advantage by many in judging the appearance and expression of the posing person up to the instant of exposure.

The Home Portrait Graflex has the revolving back and is available only in the 5 x 7 size. It is a large



27. HOME PORTRAIT GRAFLEX 5 x 7 REVOLVING BACK. Note its lens front which rises, lowers, and tilts. Note its removable, interchangeable lensboard.

28. CONVERTIBLE BAUSCH & LOMB PROTAR LENS, suitable for use in Auto Graflex and Home Portrait Graflex Cameras.

camera but much more convenient to carry around and to operate than a view camera. The Home Portrait Graflex is equipped with a lens front that rises, lowers, and tilts. Its interchangeable lensboard, measuring 5 inches square, will accept any number of lenses with apertures as large as f/3.5 and with focal length from 10 to 12½ inches. The minimum focal length of lens which it can accommodate is 10 inches. Its bellows draw capacity is 13¾ inches. It is an excellent camera for making large size portraits without the necessity of approaching the subject too closely — an important advantage in home portrait work.

The above features are available in Home Portrait Graflex in addition to the Graflex features such as self-erecting focusing hood, special focal plane shutter with speeds ranging from 1 full second to 1/500, and time exposures. Its revolving back is designed to take any of the Graflex film or plate accessories.

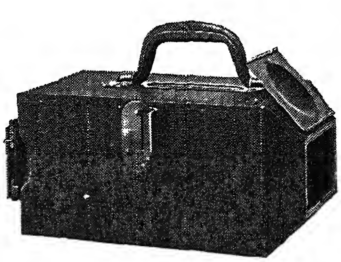
Special Press Model

The Home Portrait Graflex is available on special order in a model designed especially for news photography, such as sports and long range photography. This special model is equipped at a slight extra cost with a special focal plane shutter having speeds up to 1/1000 of a second. This model is regularly available with 20- and 24-inch telephoto lenses. However on special orders, lenses as long as 40 inches and even 60 inches can be especially fitted.

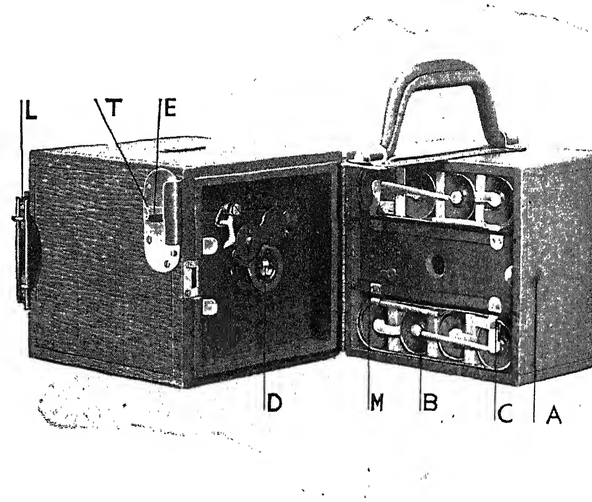
This is the camera which has acquired the "nick name" of "Big Bertha" described in detail in the chapter, Special Cameras (see page 279).

The Finger Print Camera

The Finger Print Camera represents a complete self-contained unit for making actual size reproductions of any subject on a plane surface within an area measuring 2⅛ x 3⅛ inches. The description "self contained" is quite appropriate for this camera because it has built into it everything necessary to make a picture, including lights.

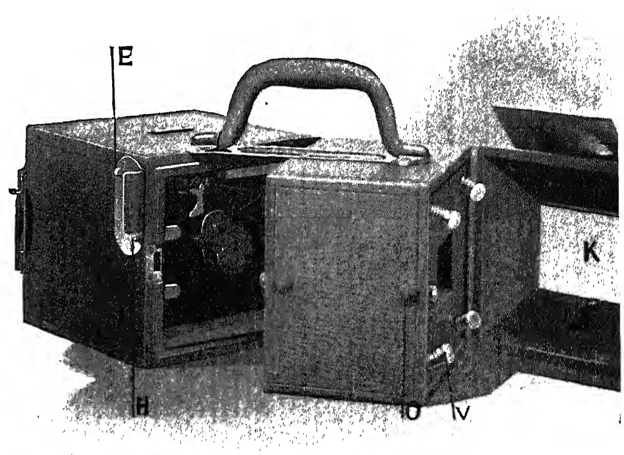


29. FINGER PRINT CAMERA. The Finger Print Camera is a self-contained unit having its dry cell battery operating light source built into it.



30. LENS AND SHUTTER MECHANISM OF FINGER PRINT CAMERA. D. f/6.3 Kodak Anastigmat lens; E. Exposure Lever; T. Register line, indicating open lens. L. Film holder (film pack adapter or sheet film magazine can be used): M. Drawer containing six extra miniature lamps; B. Dry cell batteries; C. Brass contact points; A. Concealed spring release.

The finger print camera, usually carried by detectives and law enforcement officers, must be available for instant use in or out of doors and must be entirely independent of any outside current supply. This type of camera was originally designed specifically for use in law enforcement work. However additional fields of application opened themselves due to the simplicity, compactness and portability of this unit. It can readily be



31. VIEW OF FINGER PRINT CAMERA SHOWING: O. Concealed spring release for opening of front of camera. V. Four miniature lamps operated by batteries, K. Camera front aperture measuring 2¼ x 3¼ inches; I. Front metal door on cone section (N); H. Small button for lighting lamps without use of shutter mechanism.

employed for photography of coins, stamps, small designs, passes, jewelry, portions of printed matter, etc., provided such copy work comes within proper government restrictions. Recently this camera has been successfully used in photography of small skin lesions, portions of the scalp, insects, small pathological specimens, etc.

The camera is equipped with a fine f/6.3 Kodak anastigmat lens which is unalterably fixed in the camera at such a point that it renders a full size image of the subject with excellent definition. The shutter mechanism is simple and most ingenious. It makes the exposure not only because it opens and closes the shutter, but because it also turns on the lights for the desired length of time.

32. **FINGER PRINTS:** full size reproduction obtained with Finger Print Camera.

The self-contained illumination is provided by four miniature lamps housed in the camera box. They are located inside the camera, directly back of the front aperture of the camera, are easily accessible for renewal, and are automatically controlled. They properly illuminate the subject and, being provided with special shields, do not allow stray light to hit the lens. A compartment within the camera box carries an extra supply of these lamps.

Crown View Camera, 4 x 5

A special chapter, The View Camera, (page 161) is devoted to its use and application. The camera is a favorite of advanced photographic workers, and, though it is now somewhat overshadowed by the new Graphic View Camera, its salient features are briefly offered here for the benefit of its users and for comparison with its new companion.

The Crown View Camera uses negatives of 4 x 5 inches. It has a double extension bellows which allows its being drawn out to the limit of 19 inches. Its minimum bellows extension, of significance for users of wide-angle lenses, is $3\frac{9}{16}$ inches. The camera is equipped with a rising, falling and shifting front, which allows the rise of the lens up to 1 inch above its normal center position; its fall, down to $\frac{13}{16}$ inches below its normal center. The lateral shift of the front standard enables the movement of the lens up to $1\frac{3}{16}$ inches to either side of its normal center.

The tilting and swinging back, which can be extended upon the rear extension of its track, will produce a horizontal swing of the back up to 12°—and also a tilt of the back up to 12° vertical.

Of particular interest to owners of 4 x 5 cameras, is the fact that they can advantageously employ either Graphic or Graflex film and plate accessories in connection with the Crown View Camera. This camera also has great appeal to owners of the 3¼ x 4¼ Speed Graphic and Graflex cameras. These accessory backs are available either in the Graphic back style or in the Graflex back style, allowing the use of Graflex film and plate holders with the focusing panel or Graphic plate or film holders and Kodak film pack adapters in the 3¼ x 4¼ size.

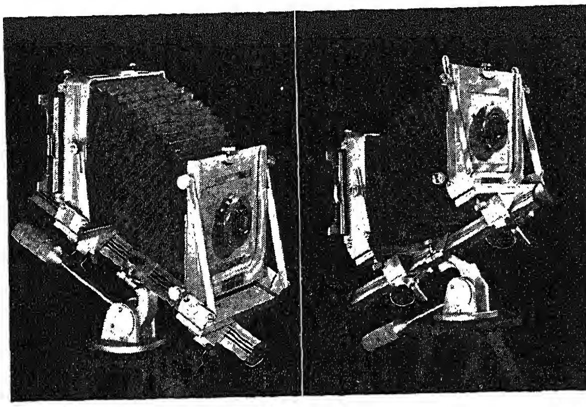
The companion to the Crown View Camera is the all-metal Graphic View Camera, the operation of which is described in the chapter entitled: "Improving Perspective with the Graphic View Camera." (Page 389.)

Graphic View Camera, 4 x 5

This camera is not only entirely original in many of its features, but it conclusively proves that it has been produced in response to specific demands of photographic workers for such features as would provide a truly modern view camera. View cameras have, for many years, remained within the domain of professional photographers, and have not been much exposed to modernization. Thus the appearance of the Graphic View Camera, with all its excellent external, structural and operating features, was hailed as an important photographic event.

Briefly, the Graphic View Camera is an all-metal unit, made to high standards of accuracy and precision. For the first time, the designer of this camera has done away with the cumbersome and frequently troublesome two or three-piece wooden base with its rack-and-pinion control.

As a true departure from the conventional view camera design, this camera is supported by an inverted V-section aluminum alloy bed. The front and back of the camera are moved along it by large and convenient focusing knobs upon a smooth-running rack-and-pinion track which is appropriately located on the under side of the bed: out of harm's way, and protected against dust and dirt. The front and back of the camera can be



33. 4 x 5 GRAPHIC VIEW CAMERA. The new all-metal Graphic View Camera is shown here in two of the many possible positions. Either shooting downward (left), or upward (right), linear perspective on the negative may be easily and quickly altered by tilting lens and film backward or forward to produce parallelism of vertical lines.

firmly locked in any position by quick-acting focusing clamp levers. This arrangement makes it possible to shift the entire camera forward or back, an important feature to preserve arrangement of the camera, or to prevent cutting off of portions of the image, when working with wide-angle lenses.

Another part of the camera which forms a true and useful innovation, is the smoothly-working pan-and-tilt base, which also serves as a tripod head. This base permits quick, easy and accurate placement of the camera in any desired position, which is secured for both horizontal and vertical setting by an easy twist of its handle.

Figure 33 shows two of the many possible positions and settings which the camera can quickly and conveniently assume: the left view shows the camera for downward shooting, while the right view shows it directed upward.

The Graphic View Camera is equipped with a rising and falling front, which permits for an unusually high raising of the lens, effected by the rack-and-pinion movement activated by a control knob, easily locked.

The front and back have provisions for a generous tilt forward and back. The guiding braces which control the extent of the fore-and-aft tilt are accurately made, and are of such length that tilting the front and back to the full extent in the same direction will make them parallel. Notches in the center of the slots of these braces indicate vertical setting, while the intermediate notches make the front and back parallel with an intermediate tilt backward.

Lateral shifts for both the front and the back of the camera are provided with spring-clicks indicating dead center. There is also a swing provision made for the front or the back of the camera, with the dead-center position also indicated by means of spring-clicks.

The back of the camera is equipped with a built-in spirit level, to the right and left of which are convenient clamps for holding the focusing cloth on the camera. The camera has a Graphic back, but accessory Graflex backs are available for it. The back is of the reversible type, easily changed over from vertical to horizontal compositions. The metal lens-board is 4 inches square, (interchangeable with Speed Graphic lens-boards) and is held in place by the simple and efficient slide-lock. An accessory lens-shade of the accordion type is available for the camera, and is fastened to the top of the front standard by means of a set-screw.

The limit of bellows extension is 12½ inches, which permits a 1:1 reproduction ratio with lenses of focal length up to 6 inches. As in all view cameras, a wide choice of lenses is available for the Graphic View Camera, ranging from the 3½ inch wide-angle lens up.

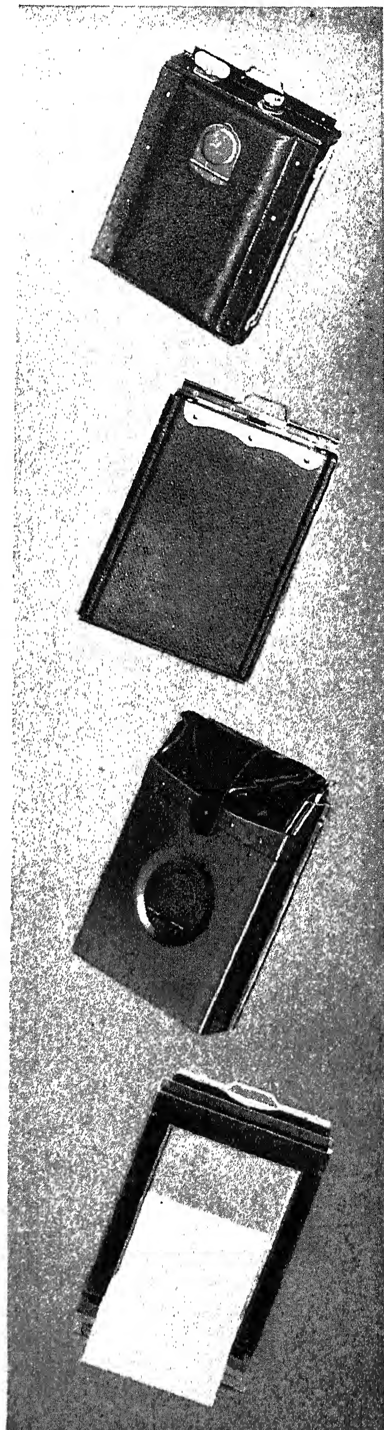
The camera is furnished in an attractive and sturdy gray fibre case, fitted to accommodate it safely, together with a great many accessories. The operation and handling of the many features and controls of the Graphic View Camera are aptly described on page 389 to which the reader is referred.

Speed Graphic and Graflex Accessories

Probably the most important accessory in the Graflex and Speed Graphic cameras is the lens. The subject is brought up at this point in connection with the fact that many photographers have extra lenses at the time of acquiring a new Graflex or Speed Graphic camera. Also many of them have opportunities for buying or obtaining certain accessory lenses and wonder whether they might be used for their Graflex or Speed Graphic cameras. While the important subject of choosing a lens is adequately covered in the chapter entitled How to Choose a Lens, it seems proper to place here tabulated information at the disposal of photographers, which will enable them quickly to judge the suitability of a lens for their Speed Graphic or Graflex cameras. As a matter of general policy, it is always best to send the lens with the camera to the Folmer Graflex Corporation or their accredited representative through your photographic dealer. Fine differences between lenses of the same make, type and focal length make it important that a lens be individually fitted to each camera whether it is a Speed Graphic or a Graflex: in the former instance, because of the desirability to have accurate calibration in connection with the range finder, tubular view finder and focusing scale. In the second instance because of the precision required for mounting a lens in connection with the reflecting mirror.

The accompanying table gives approximate angles in degrees, measured across the diagonal of the film plane for the

4 x 5, 3¼ x 4¼ and 2¼ x 3¼ cameras and also for the width and height. This table indicates the angle of the field of view for lenses ranging from 3 inches focal length to 17 inches. Careful study of this table will make it readily apparent that a lens of a certain focal length which may be considered as standard for the 2¼ x 3¼ camera, will be a wide angle lens if used with a 4 x 5 camera. This however should not be construed as meaning that a lens of a definite focal length, which is used on a smaller camera can be used indiscriminately as a wide angle lens on a larger camera: it is unlikely that such a lens will "cover" the entire negative area of the larger camera.



Graflex Roll Holder

Graflex Film Pack Adapter

Graflex Sheet Film Magazine

Graflex Sheet Film Holder

Film and Plate Attachments

Great variety of negative material is available for use with Speed Graphic and Graflex cameras. This is an important consideration to photographers who are eager to take advantage of modern photo-sensitive materials with their latest improvements. Because many film and plate attachments are available for use with Graphic and Graflex cameras, which in most instances are interchangeable, owners and users of these cameras can employ any one or all of the four types of photo-sensitive materials: roll film, film packs, sheet film, or glass plates.

Graflex Roll Holder

This accessory is detachable and interchangeable with other Graflex attachments, which means that it will fit the Graflex back, whether such back is provided on the Graflex or Graphic camera. Available in 3¼ x 4¼ (referred to as No. 51C), 4 x 5 (referred to as No. 53C) and 5 x 7 (referred to as No. 54) it takes special six-exposure roll films. Provided with a special positive film lock, the Graflex roll holder is capable of delivering an almost plate-like efficiency in the use of roll film with the many desirable features of the latter. It is ingeniously designed, provided with a slide and a spring-activated window for observing exposure numbers. This window remains always closed, except when opened for inspection. This eliminates danger of fogging even in fast panchromatic emulsions. It is conveniently reloaded without the necessity to remove the roll holder from the camera. Only the carrier is removed for loading, after which it is returned to the holder, locked and again available for exposures.

Film Pack Adapters

This accessory is desirable when quick reloading counts. Twelve-exposure daylight loading film packs in a variety of emulsions are available everywhere. Ruggedly constructed, the Graflex film pack adapter is available in the following sizes: 2¼ x 3¼, 3¼ x 4¼, 3¼ x 5½, 4 x 5, 5 x 7. In these sizes it is interchangeable with other Graflex attachments, and can be used on either the Graphic or Graflex cameras provided with a Graflex back.

Film packs can be loaded in daylight but never in strong light or direct sunlight. When film pack is being unwrapped it should never be held otherwise than by its sides; if the protective black paper appearing in the front opening of the film pack is depressed, much film will be fogged. The film pack adapter back is opened by releasing both catches at its end simultaneously. The

film pack is carefully inserted into the film pack adapter and with its paper tabs held straight out, the pack is closed. Both catches should lock and the black safety paper should be removed before the film pack is ready for the first exposure.

For the Miniature Speed Graphic a Graphic film pack adapter is available in the 2¼ x 3¼ size. It is readily accommodated under the spring activated focusing panel of the Miniature Speed Graphic. This film pack adapter is easily distinguished from the Graflex film pack adapters because, unlike the others, it is not leather covered, but finished in durable black coating. This makes it thinner and permits its easier insertion and withdrawal.

Graflex or Graphic Sheet Film or Plate Holders

Sheet Film or Plate Holders are available in either the Graphic type, which will fit the Graphic spring activated back or the Graflex type. The difference between the Graphic and the Graflex film or plate holder is that the Graflex attachment is grooved along each of its two side edges, while the Graphic attachments are not.

The *Graflex sheet film holders* are available in the following sizes: 2¼ x 3¼, 3¼ x 4¼, 4 x 5, 5 x 7. The Graflex plate holders are available in the same sizes and in the 3¼ x 4 size (for lantern slides).

Graphic sheet film and plate holders are available as follows:

APPROXIMATE ANGULAR FIELDS OF LENSES (IN DEGREES) OF VARIOUS FOCAL LENGTHS ON STANDARD FILM AND PLATE SIZES

Dimensions used refer to diagonal, width, and height of plates or films, respectively

Focal Length of Lens		*Plate Size:* 4 x 5 inches			3¼ x 4¼ inches			2¼ x 3¼ inches		
cm.	inches	6.4″	5″	4″	5.3″	4¼″	3¼″	3.9″	3¼″	2¼″
7.5	3	93°	79°	67°	83°	70°	57°	66°	57°	41°
8	3-1/8	91	77	65	81	68	55	64	55	40
9	3-1/2	84	71	59	74	62	50	58	50	36
10	4	77	64	53	67	56	45	52	45	31
10.5	4-1/8	75	62	52	65	54	43	50	43	30
11	4-3/8	72	59	49	62	52	41	48	41	29
11.5	4-1/2	71	58	48	61	50	40	47	40	28
12	4-3/4	67	55	46	58	48	38	45	38	26
12.7	5	65	53	44	56	46	36	43	36	25
13.5	5-1/4	63	51	42	53	44	35	41	35	24
14	5-1/2	60	49	40	51	42	33	39	33	23
15	6	56	45	37	47	39	31	36	31	22
16.2	6-3/8	54	43	35	45	37	29	34	29	20
16.5	6-1/2	52	42	34	44	36	28	33	28	20
27	11	32	25	20	27	22	17	19	17	12
30	11-13/16	30	24	19	25	20	16	18	16	11
30	12	30	23	20	25	20	16	18	16	11
32	12-1/2	29	23	18	24	19	15	17	15	10
33	13	28	22	17	23	18	14	16	14	10
35.5	14	27	20	16	21	17	13	16	13	9
36	14-3/16	27	19	15	21	16	12	15	12	8
38	15	24	19	15	20	16	12	15	12	8
43	17	21	17	12	17	14	11	13	11	7

Sheet film holder 3¼ x 4¼ and 4 x 5.

Graphic Press plate holder 4 x 5 only.

The 5 x 7 sizes are available only as Century sheet film or Century plate holders.

Sheet film holders are loaded in the darkroom. It is best to prepare one or all sheet film holders in advance before turning out the light. Both dark slides should be withdrawn and partly reinserted, making sure that the bright sides of the handles with raised dots upon them are on the outside. They are then neatly stacked upon each other and the light is turned out. As the box containing the sheet film is opened, each sheet of film is interleaved with a sheet of black paper. Each sheet of film is provided with an identification notch that not only identifies the type of the film emulsion, but assists to distinguish in the dark the emulsion side from the film support side.

When the notch appears and can be felt along the top edge at the upper right hand cover, the emulsion side is facing the operator. (Consult PHOTO-LAB-INDEX, pages 221 to 225, for keys to film notching codes of all popular makes.) While holding the sheet of film by opposite edges between the thumb and fingers, the wood flap at the end of the holder is opened (swung outward) and the film is slid into it. Its edges must glide beneath the side rails of the film holder, and should be pushed home so that it gets under the rail on the other end of the holder. This is most effectively achieved by placing the left forefinger nail under that portion of the rail while pushing the film from the open end. A little practice with fogged film in open light will quickly render the loading of the cut film holder a simple routine performance in the darkroom.

Plate Holders

Plate holders are loaded in much the same manner as film holders, except that there are no rails at the sides to contend with. The end of the plate is concealed under a projection at the far end of the holder. The plate is held in place as the wood flap of the opened end is closed, and the dark, light tight slide inserted.

Graflex Sheet Film Magazines and Plate Magazines

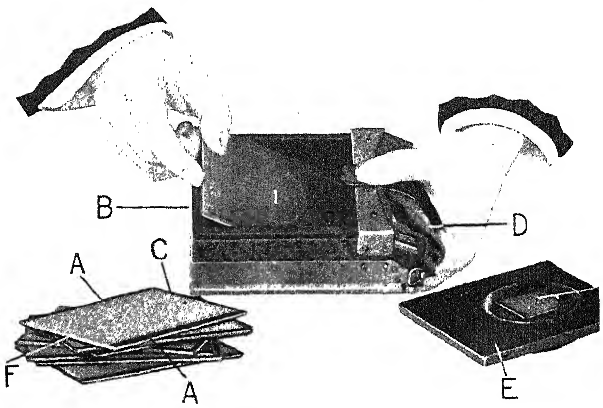
This remarkable Graflex accessory has such popular appeal because it is probably the most universally applicable film or plate holding and dispensing device. Interchangeable with other Graflex attachments, it is extensively used on Speed Graphic cameras which are fitted with Graflex back. The popularity of sheet film magazines has been greatly enhanced since the advent of the lens-coupled range finder which renders the use of ground glass focusing not always necessary.

The Graflex magazines are available in the following sizes:

12 sheet film capacity, 2¼ x 3¼, 3¼ x 4¼, 4 x 5, 5 x 7

18 sheet film capacity, 3¼ x 4¼, 4 x 5

12 plate capacity, 3¼ x 4¼, 4 x 5, 5 x 7



36. GRAFLEX SHEET FILM MAGAZINE: A. Slide flanges of septum; C. End flange of septum; D. Small leather changing bag; B. Concealed spring at bottom of magazine serving to release cover (E); K. Cover of small window indicating number of septums; F. Stack of septums (sheaths).

The sheet film or the plate magazine consists of a rectangular housing, having at its front the regular removable dark slide, and at its back a removable cover provided with a spring-activated window closure. The chamber of the magazine accommodates 12 or 18 metal sheaths or septums. Each septum is numbered on its back with bright raised metal figures which appear through the ruby window in the back of the magazine as each exposure is made. The back of the magazine is provided on its inside with strong springs which accomplish proper retention of each film in exact focal plane. When a film or plate is exposed, the septum containing it is drawn into the miniature soft leather changing bag attached to the end of the magazine, by being pulled out with the aid of a sliding rod. The septum just withdrawn is grasped by hand through the soft leather changing bag, and reinserted into the back of the magazine. A little practice will result in deft handling of the sheet film or plate magazine easily.

The films or plates are held in place in the septum by means of flanges. Embossed ridges underneath serve as means to keep the film or plate against the retaining edges of the flanges and in the exact focal plane. The magazines are loaded in the darkroom. The back of the magazine is removed by pressing upon a concealed button at the bottom of the magazine. The septums are removed from the magazine and loaded by simply sliding the film or plate beneath its flanges. The loaded septums are then placed, preferably one at a time, into the magazine chamber with the closed end of each septum inserted toward the folding changing bag. This last suggestion is so important that it is hereby repeated. *Caution:* When loading the magazine, the septum hold-

ing film or plate must be placed into the chamber with its closed end toward the changing bag.

It must be remembered that the septums should be placed into the chamber in consecutive order of their numbers 1 to 12, the latter to be nearest the back. When loading the septums, the first should be allowed to drop flat into the magazine with the open end forced back against the lower end of the magazine, opposite the bag. If this is followed, the second septum and all others to follow will drop into proper position. Should the first two septums be placed in the magazine at the same time at an angle of 60 or 70 degrees, the second septum is apt to force its way into the opening (throat) leading into the changing bag. If it is then pushed down, it is likely to bend and prevent smooth operation of the magazine. After the cover of the magazine is replaced, the unit is ready for operation.

Septums should never be forced in or out of the chamber. They are made of thin material, likely to bend. A septum, once bent, scored or deformed, will cause interference in the smooth performance of the unit. They should be well cared for and never mishandled. Also, we might add that the possible use of film septums in the plate magazine is not recommended. The films will be out of register and the septums will jam.

The great advantage of either the sheet film or plate magazine is that it allows loading and removal of negative material singly or in multiples for exposure or development as necessity may arise. Another advantage is that a variety of materials can be loaded into the magazine, provided suitable memorandum is penciled upon a piece of adhesive tape affixed to the back of the camera. Thus it is quite feasible to equip oneself with the aid of one sheet film magazine for a day's work with, say, six sheets of professional Kodachrome, three sheets of medium speed black and white film, and three more sheets of high speed panchromatic sheet film for night exposures. This is merely an example, of course, to illustrate one of the possibilities. It should be remembered however that when one or more exposed films or plates are removed for processing before others are exposed, the empty septums should be returned to the magazine for its proper performance for additional exposures. It is necessary to keep the full number of septums in the magazine, whether loaded or not, to produce the proper pressure against the back springs in order to hold forward septums in the focal plane.

Dark Slides

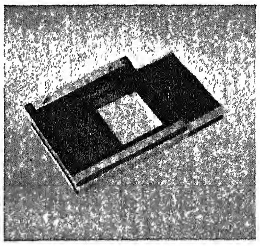
Every Graflex or Graphic film or plate accessory, including the roll holder and film pack adapters is provided with a slide made of special flexible smooth composition. The outwardly protuding end of each slide has a rounded, metal edge, one side of which is blackened, while the other remains of bright metal. The bright metal side has raised dots on the outside. These raised dots are provided so they can be felt and distinguished in complete darkness. When this slide is replaced in the holder after the film has been loaded into it, the raised dots should face outward.

Certain types of composition from which dark slides are made are transparent to infra-red radiation, and infra-red film kept in holders with such slides is frequently found to be fogged. Graphic and Graflex slides, identified by 5 (not 3) raised dots on their metal edges, are made of specially tested hard rubber and are safe for infra-red film.

After an exposure is made the slide is replaced in the holder with these raised dots of the bright metallic side facing inside. The darkened side of the handle will now indicate that the film had been exposed. This is a universally adopted code familiar to all experienced photographers, who can at a glance tell which of their film holders contain exposed negatives. The insertion of the slide in the holder following loading, with the raised dots on the outside — and the reinsertion of the slide following an exposure, with its darkened side outside, should become a part of a rigid routine which will preclude double exposures and other mishaps. The same should be said about the simple but most frequently forgotten part of the routine: the withdrawal of the slide itself before each exposure, and its replacement immediately after each exposure, before anything else is done.

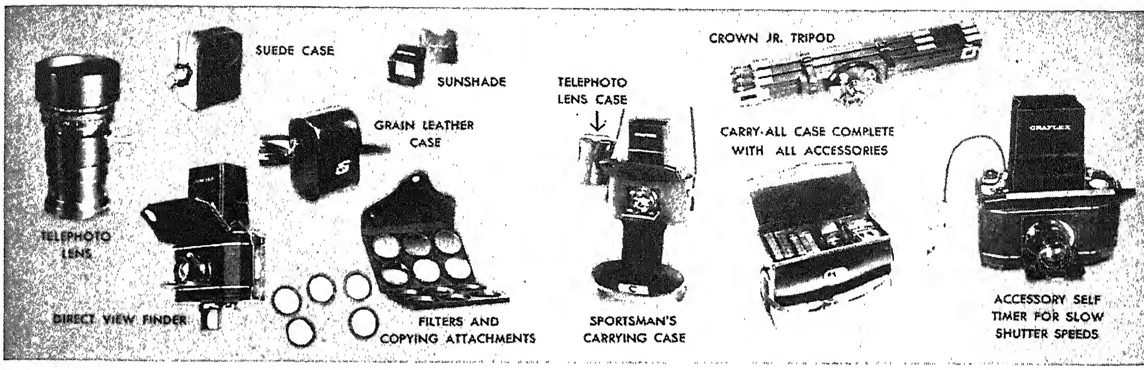
Dividing Backs

This is a very interesting accessory available for the Graflex back either in connection with the Graflex or Speed Graphic camera. It permits the taking of two pictures on either 3¼ x 4¼ or 4 x 5 camera. Interchangeable with any other Graflex film accessories, the dividing back makes use of the sliding back principle.



37. GRAFLEX DIVIDING BACK. This accessory is interchangeable with other Graflex film accessories available for 3¼ x 4¼ or 4 x 5 sizes. See text.

It fastens to the Graflex back of a camera, and any Graflex film or plate accessory is fastened to its own back. With it either the left or the right half of the film can be exposed, following which, the second exposure can be made on the other side of the film. It should be remembered that, when used with the Graflex camera, it cannot be employed in connection with the reflex mirror focusing, because it places the film or plate



38. NATIONAL GRAFLEX ACCESSORIES.

1-3/16 inches back of its original focal plane. For this reason a focusing panel must be employed in connection with the dividing back whether it be used with a Graflex or Graphic camera. On some Graflex cameras with regularly listed lenses the maximum working distance may be limited to only 4 or 5 feet.

Backs for Speed Graphic camera. Either the complete Graphic back or Graflex back, the latter with focusing panel containing ground glass, are available in the following sizes; 3¼ x 4¼, 4 x 5, 5 x 7. Of interest to some photographers owning a 3¼ x 4¼ Graphic camera should be the availability of a 2¼ x 3¼ revolving back with focusing panel for 3¼ x 4¼ camera. This revolving back is easily installed by means of a few small screws and may be advantageously employed whenever, for certain reasons, a large number of smaller negatives have to be produced when only a 3¼ x 4¼ Speed Graphic is available.

Tripods

The description of the Graflex line would not be complete without mentioning their tripods. They are available in a number of sizes and all are made of oil soaked and water proofed selected cherry wood. Most experienced photographers have a well justified leaning towards wooden tripods for the simple reason that regardless of the amount and type of use and abuse to which they may be exposed for years, nothing, short of breaking them in two, will impair their usefulness. They do not bend out of shape: a scratch, a scar or a gash will have little effect upon their stability and rigidity, and their light weight makes them comfortable to carry. The Crown Junior tripod makes a practical support for the National Graflex and other miniature cameras. It is easily collapsible and fits into the special Graflex carrying case designed to hold the Speed Graphic and accessories.

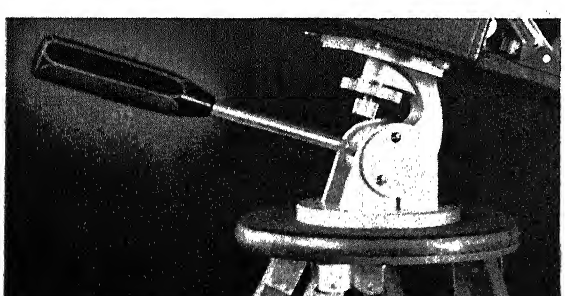
The Crown tripods are recommended for use with cameras from 3¼ x 4¼ inches. To increase its usefulness, the Crown tripod tilting top is a worth while addition which permits a 90-degree movement of the camera from horizontal to vertical.

The Graphic Pan-Tilt Tripod Head

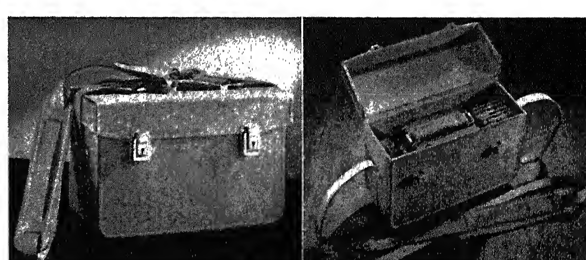
This useful accessory is quite similar to the combined camera-base and tripod-head of the Graphic View camera. Its tilting and rotating movements are both controlled and locked by its single handle. The head is so designed that it can be half-locked with the camera held in position with sufficient freedom to permit deliberate movement. A slight further turn completes the locking.

The adjustable camera clamp screw is large enough to provide a secure gripping surface. It also has a spring arrangement to keep the clamp-screw in the *up* position so that insertion of the screw in the tripod socket is greatly facilitated. In use, the lower grip is rotated to sink the screw to the full depth of the tripod socket in the camera, and then the upper (larger) grip is turned to pull the camera down tight against the top of the tripod head.

The top of the Graphic Pan-Tilt Tripod Head is 2⅛ inches square and the circular base has a diameter of 3½ inches:



39. GRAPHIC PAN-TILT TRIPOD HEAD offers firm support to the camera combined with ease and smoothness of panning and tilting movements.



40. CARRYING CASES FOR SPEED GRAPHIC CAMERAS are now available in this attractive version. The illustrations show a case closed and open as it appears now, made in tough tan cowhide, with shoulder-strap equipped with non-skid pads.

generous enough surfaces to provide a firm, vibrationless support.

Graphic and Graflex Carrying Cases

Available in a great variety of sizes for Graphic and Graflex cameras, they are made of fine leather, lined with soft corduroy, and provided with lock, key, handle and shoulder-strap. While special cases, designed to accept 2¼ x 3¼, 3¼ x 4¼ and 4 x 5 Graflex and Speed Graphic cameras, can be obtained to accommodate the cameras and such accessory equipment as the photographer is accustomed to carry around, a new type of carrying case for the Speed Graphics has recently been made available in attractive and sturdy models, shown in Figure 40. Replacing the standard black leather cases, the new ones are made of tough tan cowhide, equipped with brass hardware and fitted with interior compartments lined with brownish-red plush. They will accommodate the camera with or without range finder, six plate or film holders, an exposure meter, lens shade, filters and other small accessories. They all have shoulder-straps with non-skid pads, and are available for 2¼ x 3¼, 3¼ x 4¼ and 4 x 5 Graphic cameras.

Stopping Motion

If the subject you intend to photograph is moving, its image on the plate will likewise move. It will move some during even 1/1000th second, although only about 1/10th as far as it will during 1/100th second. All the photographer can hope to do is to give a short enough exposure so that the motion of the image on his film will not be objectionable. And just what constitutes "objectionable" depends both on the observer and upon the use to which the negative is to be put. A negative which is to be enlarged 10 times or to be printed in a magazine must be sharper than if it were to be reproduced in its original size. And a print which is apt to be examined through a reading glass must naturally be sharper than one to be seen from a distance, as a highway billboard.

Not knowing precisely how his negative may be used, the average photographer must aim at "average acceptability," and it is on this basis that the following table has been compiled. It allows the photographer to take into account the four factors which are present at the time of his exposure: Namely, the *focal length* of his lens, the *distance* he will be from the subject when he releases the shutter, the *velocity* with which the subject will be moving at the instant of exposure, and the *direction* of its motion relative to the direction in which he is pointing his camera.

The following table gives the approximate velocity with which some common objects might move. In using this table, it must be borne in mind that portions of the subject may move faster than the subject itself. For example: the arms and legs of a person walking or running; the oars of a boat; the wings of a bird; the spokes of an automobile or wagon wheel. Usually a higher shutter speed will be required to "freeze" an object completely than merely to stop its motion. The following table is based on the rate of movement of the object as a whole.

5 mph.	Pedestrians. Foliage in a light breeze. Rowboats.
10 mph.	Children playing. Swimmers.
20 mph.	Foot races. Boat races. Street traffic. Divers. Jumpers. Football and Baseball games. Sailboats.
40 mph.	Horse races. Highway traffic. Power boats.
60 mph.	Trains. Motorcycle races. Birds in flight.
100-300 mph.	Airplanes. Auto races.

Suggested exposures for stopping motion at right angles to the camera when the subject moves 10 miles per hour.

	APPROXIMATE FOCAL LENGTHS IN INCHES				
DISTANCE FROM SUBJECT IN FEET	4	5	6	7	8
12	1/500	1/600	1/700	1/800	1/1000
25	1/250	1/300	1/350	1/400	1/500
50	1/125	1/150	1/170	1/200	1/250
100	1/70	1/80	1/90	1/100	1/125

These speeds are only approximate, and have been "rounded off" to give numbers easy to multiply and divide; the need of greater accuracy is doubtful in view of the uncertain speed of the object to be photographed.

This table applies to a subject moving 10 miles per hour at right angles to the camera. In all probability your subject will be doing something different. If so, you may modify the shutter speed called for in the above table by the following rules:

Double the speed of the shutter for double the velocity of the subject (1/500 to 1/1000).

Half the shutter speed for half the velocity (1/500 to 1/250).

Double the shutter speed for half the distance to the subject (1/500 to 1/1000).

Half the shutter speed for double the distance (1/500 to 1/250).

Double the shutter speed for double the focal length (1/500 to 1/1000).

Half the shutter speed for half the focal length (1/500 to 1/250).

One-third the shutter speed if the subject is coming directly toward you or going directly away from you (1/500 to 1/165).

Two-thirds the shutter speed if it is coming or going at 45 degrees (1/500 to 1/330).

When in doubt, use the next higher speed.

EQUIPMENT SUMMARY

It is frequently difficult, even for people who have owned Speed Graphic or Graflex cameras for some time, to visualize the possibilities open to them through providing their cameras with optional equipment. For this reason it is deemed best to present herewith a tabulated arrangement from which, at a glance, one can determine what standard or accessory equipment is available for these cameras.

	National Series II	Ser. B	R.B. Ser. B	R.B. Ser. D Super D	R.B. Auto	R.B. Home Portrait	Speed Graphics: Graphic Back 2¼x3¼	3¼x4¼	4x5	5x7	Graflex Back all sizes.
Graflex Film Pack Adapter		√	√	√	√	√					√
Graflex Roll Holder*	Roll Film Only	√	√	√	√	√					√*
Graflex Cut Film Holder		√	√	√	√	√					√
Graflex Cut Film Magazine (12 Films)		√	√	√	√	√					√
Graflex Cut Film Magazine (18 Films)†			√	√	√						√
Graphic Film Pack Adapter							√				
Graphic Cut Film Holder							√	√	√		
Century Film Holder										√	
Graflex Plate Holder		√	√	√	√	√					√
Graflex Plate Magazine*		√	√	√	√	√					√
Graphic Plate Holder									√		
Century Plate Holder										√	
Extra Lensboard				√	√	√	√	√	√	√	√
Carrying Case	√	√	√	√	√	√	√	√	√	√	√
Rear Focusing Panel		√	√	√	√	√	√	√	√	√	√
Filters	√	√	√	√	√	√	√	√	√	√	√
Sunshade	√			√							
Focusing Magnifier	√										
Tubular View Finder							√	√	√		√‡
Rising Front					√	√	√	√	√	√	√

*Supplied in 3¼ x 4¼, 4 x 5 and 5 x 7 sizes only.
†Supplied in 3¼x4¼ and 4x5 sizes only

√Indicates that accessory may be applied
‡ Except the 5 x 7

COMPARATIVE DATA

This table offers another type of information of particular interest to photographers wishing to select a camera to meet special requirements. This table lists, among other things, type of sensitized material which can be used with a given camera, type of tripod recommended, and other information which is needed to stand any comparison with other equipment.

	Picture Size Inches	Std. Lens Speed f/Value	Focal Length	Bellows Capacity Inches	Min. Focus Lens* Inches	Closest Working Distance	Lensboard	Crown Tripod Recommended	Sensitized Material Used
National Series II	2⅛x2¼	3.5	3"		For Telephoto lenses see supplement. Listed lens standard equipment.	42"	Lensboard part of camera.	Jr.	Roll Film
Ser. B	5x7	4.5	8½"	11		29"		4	Roll Film, Film Pack, Cut Film, Plates.
R. B. Ser. B	2¼x3¼	4.5	5½"	7 3/16		21"		1	Film Pack, Cut Film, Plates.
R. B. Ser. B	3¼x4¼	4.5	6⅜"	8 3/16		23"		1 2	Roll Film, Film Pack, Cut Film, Plates.
R. B. Ser. B	4x5	4.5	7½"	10⅛		27"		2	Roll Film, Film Pack, Cut Film, Plates.
R. B. Ser. D and Super D	3¼x4¼	2.9 3.5 4.5	Dependent on lens selected	8¼	6	According to focal length of lens used	3¼" Sq.	1	Roll Film, Film Pack, Cut Film, Plates.
R. B. Ser. D	4x5	2.9 3.5 4.5		12	7		3¾" Sq.	2	Roll Film, Film Pack, Cut Film, Plates.
R. B. Auto	3¼x4¼	3.5 4.5		15½	7		3¼" Sq.	2	Roll Film, Film Pack, Cut Film, Plates.
R. B. Home Portrait	5x7	3.5 4.5		13¾	10		5" Sq.	4	Roll Film, Film Pack, Cut Film, Plates.
Speed Graphic Cameras	2¼x3¼	3.5 4.5		9			2½" Sq.	Jr. 1	Graphic Back: Film Pack, Cut Film. Graflex Back: Film Pack,
	3¼x4¼			12	Accepts Wide Angle Lenses		3¼" Sq.	1	Cut Film, Plates.
	4x5	2.9 3.5 4.5		13½			4" Sq.	1 2	Graphic Back: Film Pack, Cut Film, Plates. Graflex Back: Film Pack,
	5x7	4.5		16			4" Sq.	2	Cut Film, Plates, Roll Film

*Varies with make, speed, and mounting of the lens.

SPIRAL STAIRWAY. Difficult problems of perspective, depth of field and over-all sharpness, such as this view presented, can be solved only with a view camera equipped with all adjustments necessary for full control of these optical variables.

IMPROVED PERSPECTIVE WITH THE GRAPHIC VIEW CAMERA

F. S. LINCOLN

A view camera is of greatest value where it is necessary to reproduce a scene in a perspective acceptable both mechanically and psychologically. The adjustability of the view camera should permit the photographer to *alter* the perspective so that it either (1) makes the picture more pleasing, or (2) gives a picture that looks more like what one thinks the object ought to look like.

There are many serious photographers, both amateur and professional, who have long been hoping for some sturdy, versatile, view camera that would perform all the antics of adjustment required for the control of the three most important optical variables in photography, viz.: 1. the linear perspective of the scene: 2. the form of objects: and 3. the position of the sharp field. The nearly perfect answer to this eternal prayer has been brought out in the unique design of the new Graphic View Camera. Its simple modern lines render it a thing of beauty of which to be proud, and the precision of its manufacture tells one: here is a camera ideally made for recording images of pictorial composition.

LINEAR PERSPECTIVE OF THE SCENE in its relation to photography is perhaps best understood by consideration of the angle of view as seen by the human eye compared with the angle of view as taken in by photographic lenses. Many people are surprised when they realize for the first time that the eye has an actual sharp range of vision of only about 15 degrees, whereas camera lenses see sharply over an angle of view ranging from 30-50 degrees, for ordinary hand camera lenses, and over 100 degrees for wide-angle lenses. Consequently, when a camera reproduces a building or other object from an angle, the lines of the object appear to be converging too rapidly in the picture. For the eye to see the same range as is taken in by a wide-angle lens, a person has to look first toward one edge of the picture field and then move his eye across the field until the other edge is seen. The rapid convergence of the horizontal lines of a flat-surface object, such as a rail fence, for instance, can be altered on the ground-glass by swinging the back of the camera on its horizontal center pivot so that it approaches a plane parallel with the plane of the object. A similar alteration can be made for excessively converging vertical lines of a building (as seen by the camera when tilted up at it) by moving the ground-glass parallel to the vertical lines of the building. Then the building lines in the image will not converge in one's picture.

All photographs by F. S. Lincoln.

THE FORM OF AN OBJECT as seen by the eye is not the same as the image of the form when focused on the ground-glass, except when the object is at or close to the center of the field of view of the lens. When the object is near the edge of the field of view of the lens, the image of the object appears distorted because of the disturbed linear perspective of the lines that describe the object. The disturbing rendering is changed by swinging the ground-glass on its vertical axis so that the edge of the ground-glass nearest the falsely rendered object is moved away from it. It is interesting to observe this alteration taking place while one swings the back of the camera. By this procedure, the image of the object will be thrown out of focus, of course, when the lens is wide open, unless mechanical adjustment of the lens position is also made, as will soon be explained. The correction for lack of sharpness can be made by stopping the lens down and lengthening the exposure, but long exposures are often prohibitive or unwanted and fortunately we have another solution, now to be explained.

POSITION OF THE SHARP FIELD is at this point ready for interpretation. As just observed, we can alter our linear and object perception at the right or left of our picture image by swinging the ground-glass-back of the camera, but at the same time we create another difficulty that must be overcome. This, as mentioned above, is the out-of-focus condition of the picture image on either side of the vertical center axis. Correction for this is easily made with the Graphic View Camera by a swing provision enabling us also to turn the lens standard on its vertical axis until the lensboard is parallel with the ground-glass. Then the image will be sharp over all when any portion of it is in focus with the lens wide open, while we still have obtained the desired alteration of the

linear and object perspective. It is a joy to be able to make pictures under this condition instead of having to resort to the lengthy exposures of former days necessary with the stopping-down-method for obtaining sharpness.

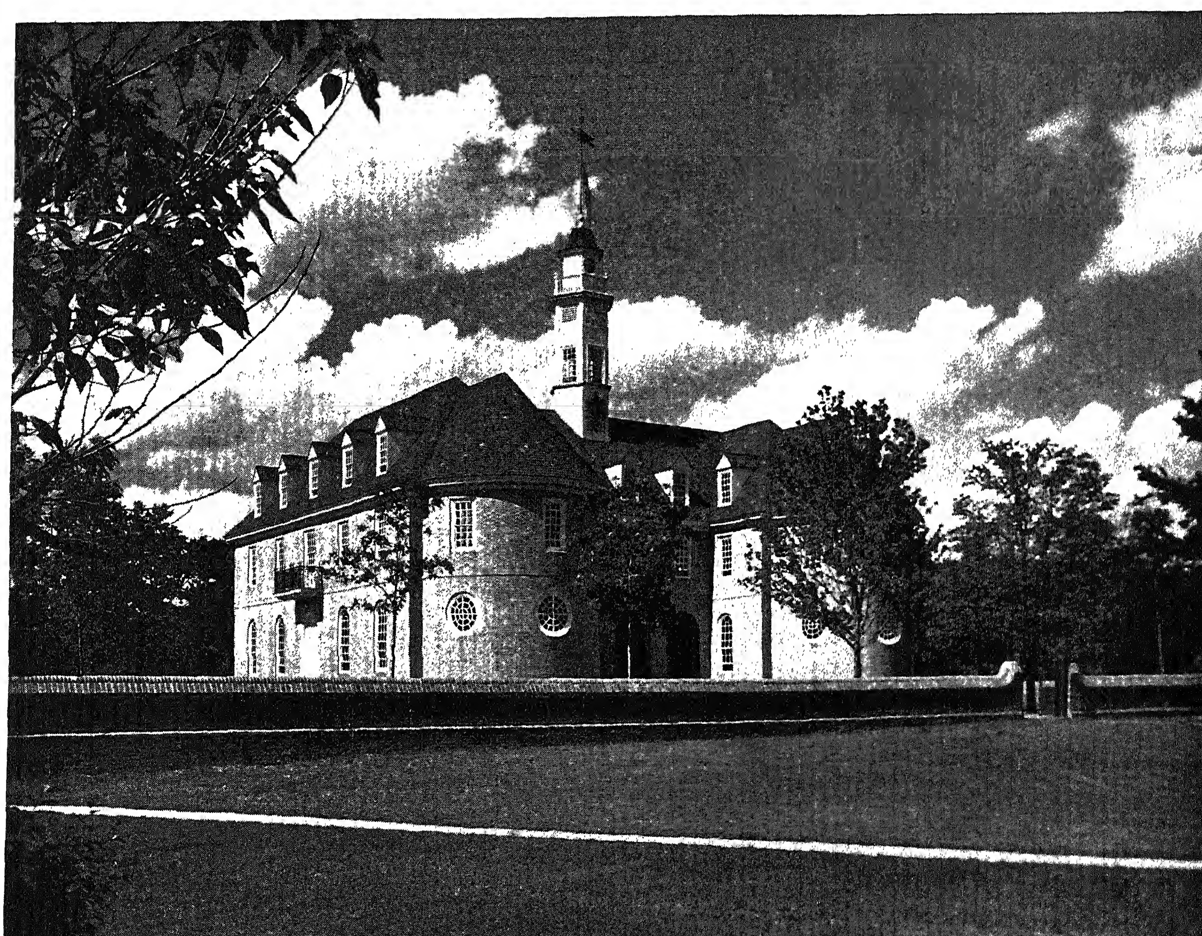
Here it may be well to explain that to take advantage of the swings to their fullest extent, one must have a lens designed to cover the added area over which one's image is distributed, amounting actually to covering ability greater than is called for by the film size of the camera. Otherwise, the far corners, or even the entire far edge, of the ground-glass, away from the lens, will be void of any image and that portion of the picture will be black if the entire film is printed.

By this time the reader has probably surmised, and the statement can now be made, that for most photographs in which the element of composition is considered, and for all photographs involving altered images, some mechanical adjustment of the camera is advantageous or necessary in addition to the ordinary forward or backward movement of the lens for focusing.

The purpose of this article from here on will be to explain some of the numerous ways in which a photographer may use the Graphic View Camera to produce satisfactory ground-glass images of the pictures that have been visualized before him. After that, the remaining procedure of photography is merely to record what has been seen and composed in image form.

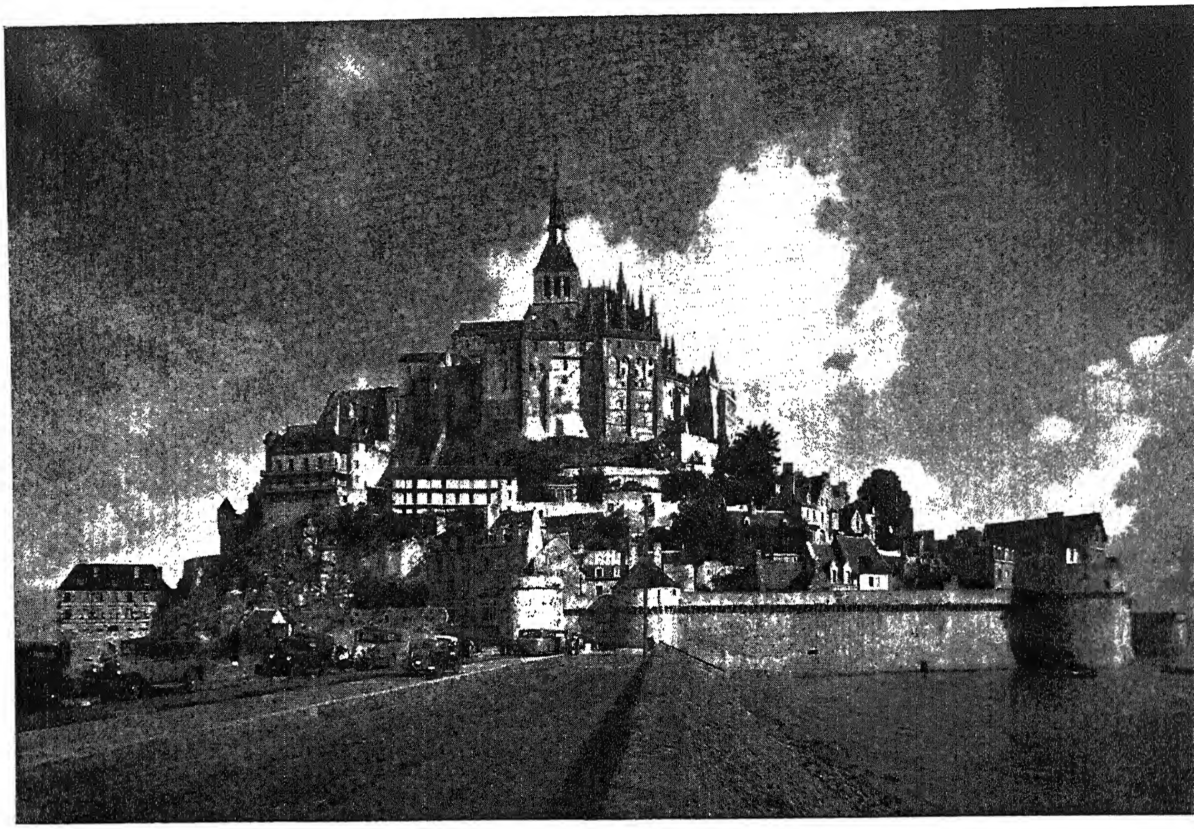
Setting up the View Camera

Let us now set up our Graphic View Camera on a tripod. First, take from the carrying case the revolving tilting-head base with its locking control handle. Fasten it onto the tripod by means of the head screw of the tripod. Open the triangular bed-clamp on top, by unscrewing the hinged thumb screw, and the bed-clamp is ready to receive the bed of the camera. Take the latter from its inverted position of storage in the carrying case, turn it upright into the picture taking position, separate the front and back of the camera on the bed, and clamp the center of the triangular V-section bed



1. THE CAPITOL, Williamsburg, Virginia.

4. THE "MUSÉE"



2. MONT ST. MICHEL

horizontally onto the tilting-head base. Tighten the hinged bed-clamp knob to secure it. Now the lens carrying assembly is in front of the clamp and the film-carrying assembly behind it. We are about ready to make a picture.

How to Control Perspective?

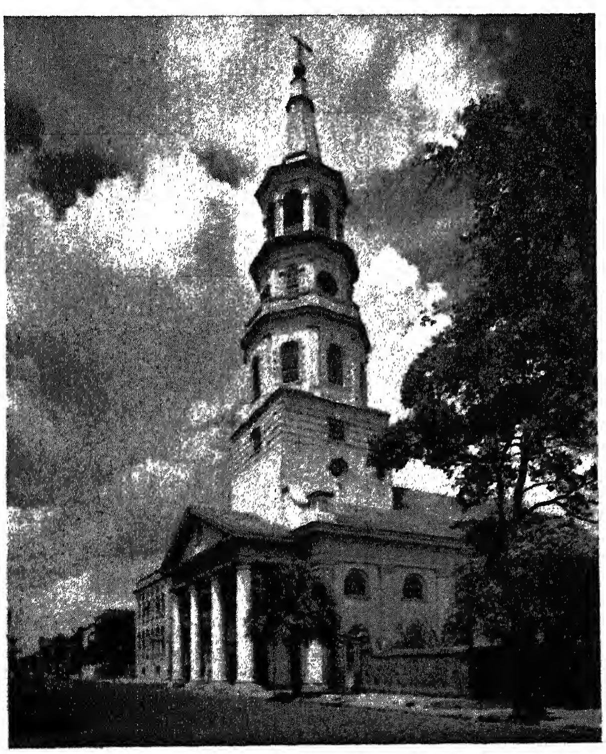
With the camera thus set up, it will be observed that the center of the lens is approximately in front of the center of the ground-glass. Lock the film carrying assembly, or the back of the camera, in position by means of the focusing-clamp lever under the V-section bed, and then move the front of the camera forward by turning the black plastic wheel focusing knob until the image of the picture is sharply in focus on the ground-glass. Lock the front of the camera in this position by the lever underneath. Lock the tilting-head base in position by turning the handle tight (clockwise) after the composition has been made as desired on the ground-glass. Set the lens shutter for the required exposure, insert the loaded film holder at the back, withdraw the slide after closing the lens shutter, and the picture is ready to be taken. With this ordinary position and adjustment of the Graphic View Camera, a photograph of the sort shown in Figure 1 might result. This is the restored Capitol building at Williamsburg, Virginia.

Suppose we now find ourselves in front of a building that is a little too tall for us to show the top when shooting straight at it. We could tilt the camera up, of course, but that would make the vertical lines converge too rapidly toward the top of our picture and not be pleasing. Observation of the ground-glass image shows that we could dispense with some of the foreground, add a corresponding area to the top of the picture, and thus get the top of the building in. This effect is easily accomplished by turning the rising front rack-and-pinion knob at the right bottom of the front standard and thus raise the lens as far as needed. Lock the lens at the required position by pulling this rising front knob out to the right, holding it securely. An example of results obtainable with this adjustment might be the picture of Mont St. Michel in Figure 2. Some of the roadway was cut off and more room added at the top of the picture to take advantage of the beautiful sky effect over the mount.

Next, consider a condition similar to the one just described, except that when raising the front a lot, we find the image on the ground-glass is partly cut off at

the top corners, or even the entire top of the picture due to the fact that the design of the lens was not such as to allow coverage over so great an area, as previously explained. The solution here is not to raise the lens so high but to get all the subject on the ground-glass by tilting the camera up. Then make the camera back vertical by loosening the two tilt arm knobs (one on each side of the back frame) that hold the braces. Re-tighten these knobs to secure the film in true vertical position and focus the image again so that it is sharp at the center of the ground-glass. At top and bottom the image will be out of focus with the lens wide open, but sharpness all over will be obtained (if the tilt is not too great) by stopping the lens down as far as necessary, depending on the tilting angle, perhaps to f:22, f:32, or even to f:45. With sufficient lighting of the subject, the amount of stopping down may be determined by direct observation. Then, of course, a relatively long exposure will be required. The "Musée" picture in Figure 4 was made in this manner, at f:45 with a 2X yellow filter, on Eastman Supersensitive Pan Film at 1/5 second exposure.

Sometimes the subject is so tall that one is almost stumped to get a picture of it from the point of view desired, as was the case with St. Michael's Church in Charleston, S. C., shown in Figure 3. Here, the Graphic View Camera would be ideal to solve the problem, with an extreme wide-angle lens, enabling the photographer to select a vantage point diagonally across the street. Notice the small area of roadway in the foreground, the great height of the steeple, and no convergence of the vertical lines. Move the lens forward to the front of the camera bed, unclamp the V-section bed from the tilting camera-base, move the back of the camera forward close to the lens and re-clamp the bed to the base behind the rear carriage. Now tilt the bed upward and adjust the camera similarly to the method for the "Musée" picture. Our goal is thus easily attained.

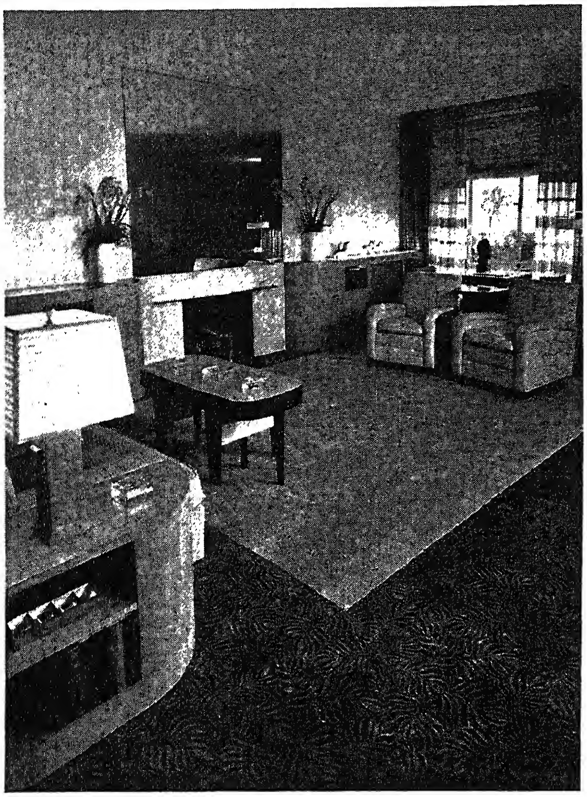


3. **ST. MICHAEL'S CHURCH** in Charleston, South Carolina.

Control of Foreground

What to do about adjustment when a lot of foreground is desired? The procedure is very simple with the Graphic View Camera. Loosen the tilting-head locking handle, tilt the camera bed downward, relock the handle, and focus. If the vertical lines of the picture are desired without convergence, adjust the camera back in the vertical position, and focus again. If sharpness all over the ground-glass is desired at wide aperture, adjust the lens into the vertical position, parallel with the film, and focus once more. Watch out here to see that the lens has sufficient covering power. A photograph that could be made with the Graphic View Camera, in the manner just described, is typified by the Karagheusian carpet shot of Figure 5. Sharpness for this subject, with the camera actually used, had to be obtained by stopping down the lens, there being no vertical adjustment available for the front lens standard.

An excellent example of a difficult photograph to make with an ordinary view camera is typified by the "KINDERGARTEN" picture, Figure 6. An essential of this shot through the doorway was the wording over it. This inscription was easily shown on the ground-glass at the top of the picture with the camera at shoulder height, but then the railing at the landing inside the doorway obscured too much of the floor of the room, giving a feeling of less space than actually existed for children to congregate in. By raising the camera up to the height near the top of the door, however, too much area above the door, and too little of the landing inside the door, was shown. The problem was solved with much labor by tilting the camera bed down, straining the bellows through use of an extreme wide-angle lens, tilting the ground-glass almost in vain into the vertical position (notice the lack of total alignment of the vertical lines), and using the swing back to make the ground-glass plane more nearly parallel with the plane of the word "Kindergarten" so that the latter would appear in pleasing perspective. Had this photograph been made with the Graphic View Camera, all the adjustments mentioned above could have been made with facility, and the



5. KARAGHEUSIAN CARPET

6. KINDERGARTEN

vertical lines of the doorway could have been rendered in wholly acceptable perspective on the ground-glass.

The Lateral Shift

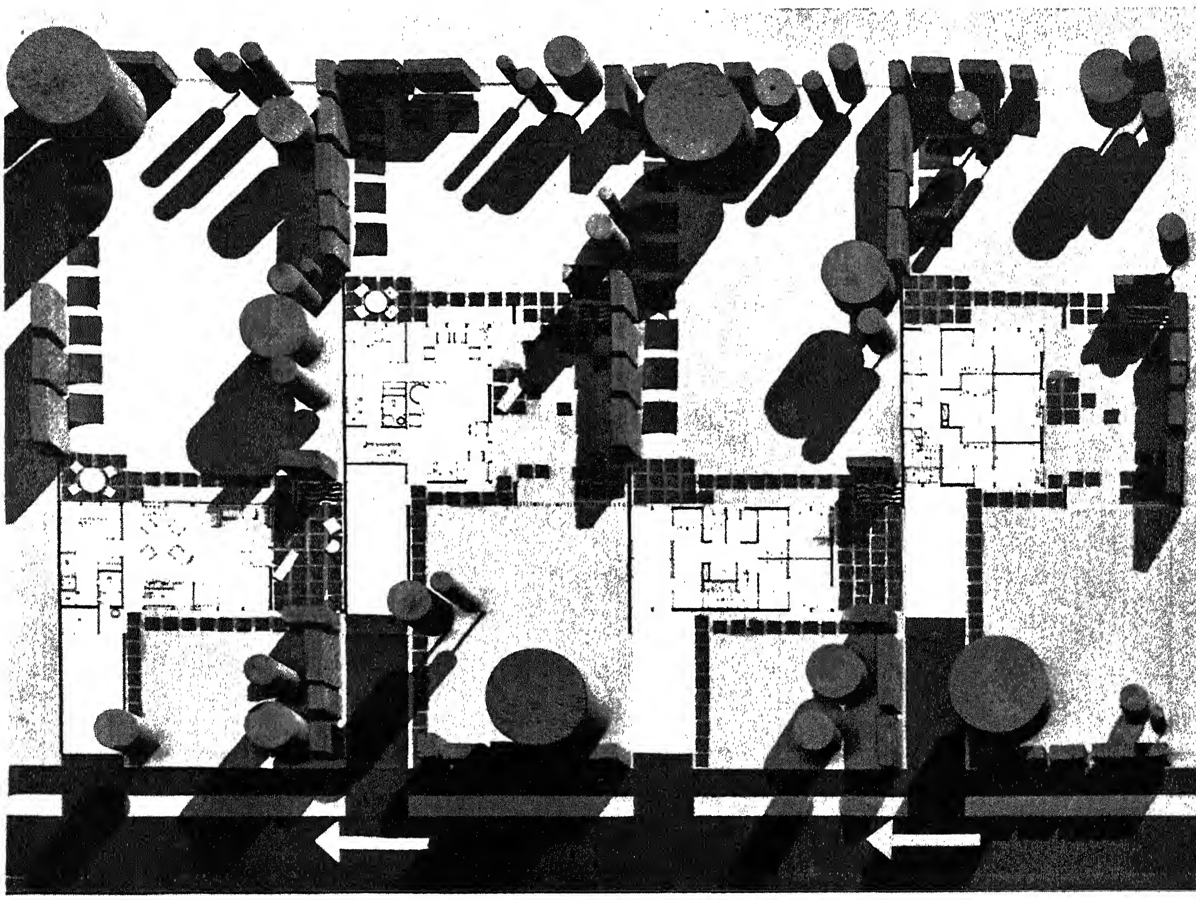
One of the important features of the Graphic View Camera, not mentioned heretofore in this article, is its lateral shift. This is often useful for obtaining lateral perspective without convergence of the horizontal lines, much the same as the rising front is used for maintenance of vertical lines without convergence.

The lateral shift can be advantageously employed at times in conjunction with the other practical adjustments of the Graphic View Camera. Take Figure 7, a housing model photograph, for example, how was this picture made? By pointing the camera down at the model at an angle, a picture would have resulted showing objects in an undesirable perspective. This particular model was only one of a series of models, all being alike except for the arrangements of the blocks representing houses. A magazine editor wanted to show a number of different arrangements effectively in a row of pictures across the top of a double page. Had the camera been placed directly above the subject, over its center, and a straight downshot made, the building sides would not have been shown at all at the center of the photo, and only slightly at the edges, by use of a lens of an average focal length. With a wide-angle lens over the center of the subject, more perspective of the buildings at the edge of the model could have been shown, but the buildings at the center would still have only their roof tops visible. This photograph was made with an 8x10 view camera and an extreme wide-angle 4½ inch Bausch & Lomb Protar f/18 lens, Series V, in the following manner: The camera was pointed straight down to the floor and the model moved along the floor into one corner of the field of view until all of the model was visible, its image occupying somewhat less than a quarter of the ground-glass area. In this manner, the model was portrayed in a way which revealed all the houses in the desired perspective. The 8 x 10 camera was a cumbersome piece of apparatus to make this picture with. What a contrast to the ready adaptability of the Graphic View Camera to solve to perfection the problem here involved, with nearly full utilization of the ground-glass and no waste of larger size film, or makeshift use of small size films stuck into the holder.

Using All Controls

This illustration of the housing model (Fig. 7) is a fitting one for a climax to this article to demonstrate

the employment, in one picture of all the mechanical adjustments the Graphic View Camera is capable of, including the two lateral shifts, yet with utter simplicity of operation. Following are the "Graphic" adjustments that would be made to duplicate the effect produced as described above (utilizing to the extreme each adjustment enumerated) : 1. Slide the lateral shift of the back frame with the film to the left: 2. slide the lateral shift of the front standard with the lens to the right: 3. tilt the back frame forward: 4. tilt the front standard forward: 5. swing the back frame to the left: 6. swing the front standard assembly to the left: and 7. raise the front. These seven operations can be performed in less time than it takes to write them. Use the same Bausch & Lomb Protar as before, tilt the camera straight downward, move the model into the field of view, focus on it, light the subject, and the exposure is ready to be made.



7. HOUSING MODEL. Read the text describing how this difficult perspective view was solved.

AN EARLY START. Photo by M. S. Chiles, Buckner, Mo.

PERSONNEL IDENTIFICATION PHOTOGRAPHY

JAMES G. LICCION

Each year the demand for Identification Photography is becoming greater and greater. In some form or another, these pictures are being used today by most of the government employees and by employees in industry, no matter how large or small. No discrimination is shown, the office boy as well as the president of a company must be positively identified before being admitted into the building. Almost all of our army and navy employees have either been or are now being photographed, and even the holders of our high government offices must be properly identified before gaining access to their offices. Photographic identification is one of the most positive systems and because identification is made possible at a glance, it saves much time over other methods including fingerprinting.

With so many organizations actively engaged in the national defense program, the need for protection against Fifth Column activities, saboteurs and spies has brought an unprecedented demand for identification photographs. These pictures are being printed on either photographic pass-cards or all-photographic badges. Because of these badges and pass-cards, unauthorized persons are today finding it extremely difficult to gain access into various industrial and government buildings.

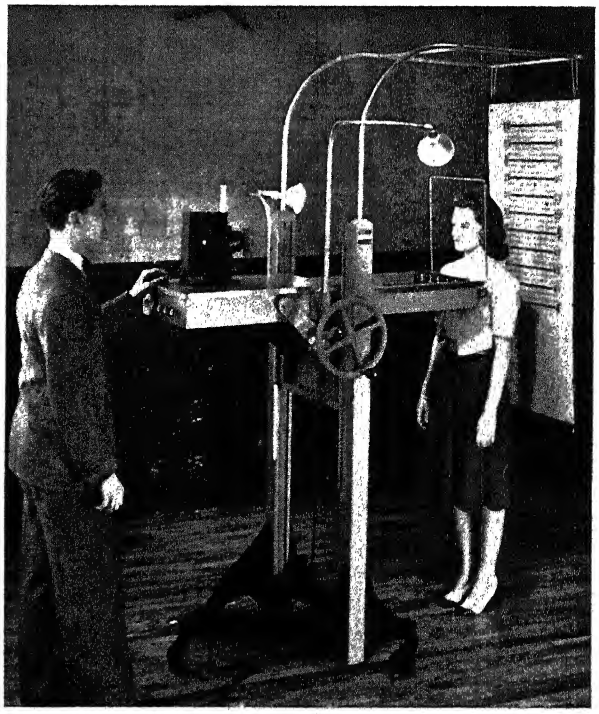
Considering this rather sudden tremendous need for personnel photography, it was necessary to have photographic equipment that would make possible mass production of identification photographs in a simple and economical way. The Folmer Graflex Corporation has developed the Graflex Identification Unit, especially designed to meet this present-day need.

The Graflex Identification Unit is completely self-contained and almost automatic in operation. As the accompanying illustration shows this unit consists of three principal elements, the camera and magazine, the stand, and the background screen with its supporting frame. Standardized lighting, exposure and focus of the Graflex Identification Unit, make it unnecessary to have an experienced operator to obtain results of uniform quality. The unit is easily set up for operation in any studio, factory, office or wherever the pictures are to be taken. Mounted on rubber-tired casters, it can easily be shifted from department to department or taken by elevator from floor to floor. This, of course, saves much time because it minimizes disruption by allowing the employees to remain on their jobs and in their departments. Two hundred pictures per hour can be easily made with this unit and on many occasions this figure has been doubled. The operating speed can be safely estimated to be as fast as the people can be brought before the camera.

Features of the Unit

Briefly the principal features of the Graflex Identification Unit are:

1. The unit is designed for the production of rapid, successive identification pictures of portrait quality on



1. THE GRAFLEX IDENTIFICATION UNIT in operation.

standard 35mm motion picture film. The size of the picture measures approximately 1 x 1⅜ inches.

2. It is completely self-contained. The lens is pre-focused at the factory. Because the lights are fixed to a movable platform, the lighting is always constant. The exposure is predetermined and remains a known factor. These features allow for fast operation, eliminating all guess-work.

3. The lighting consists of one 150 watt and one 300 watt reflectorized lamps of 1000 hour life each, and is balanced to produce portrait quality of illumination.

4. A bank of 7 dials, each containing a complete set of digits from 1 through 9, including 0 and a blank space, makes it possible to obtain on the negative a number identifying the employee, and permits the use of less than 7 numbers if desired.

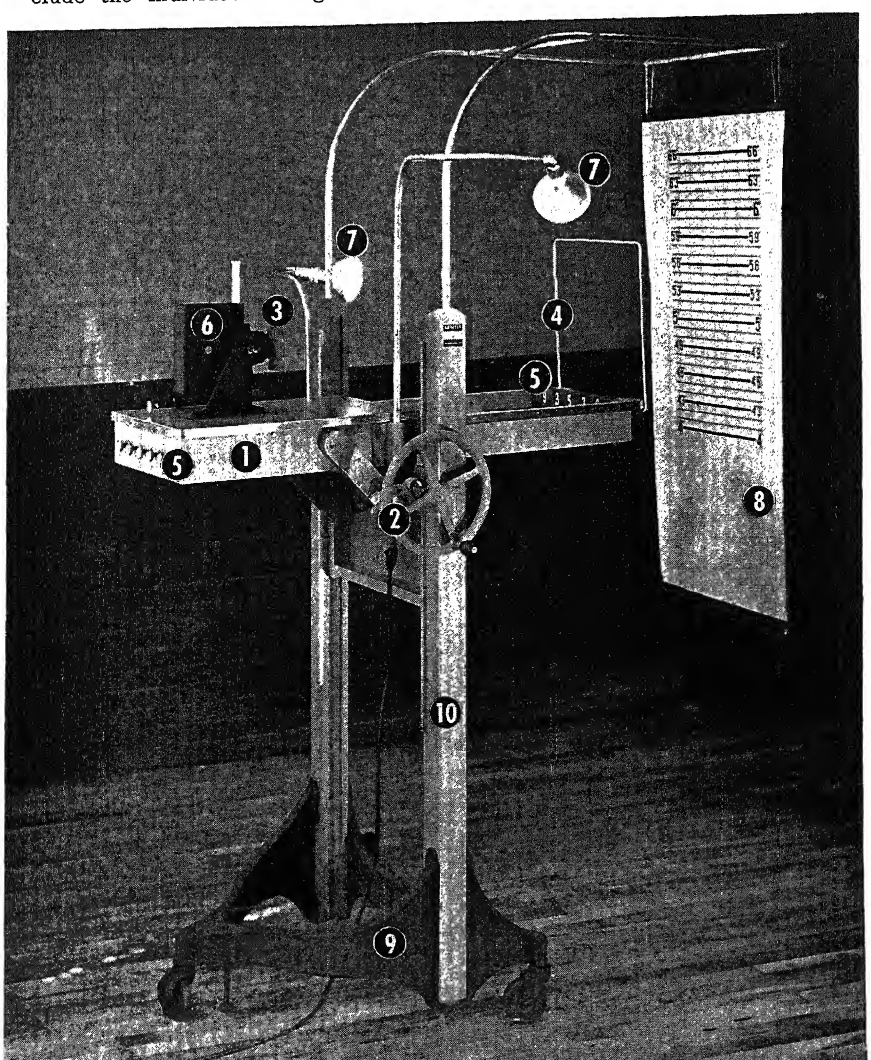
5. A background screen is marked off in feet and inches from 4 feet to 6½ feet, making it possible to include the individual's height in each picture. This screen is adjustable and can be reversed if a plain background is desired.

6. The lens is a 75mm f:4.5. It is mounted in a heavy duty shutter, permitting exposures of Time, Bulb, 1/2, 1/5, 1/10, 1/20 and 1/50 of a second. The recommended shutter speed and lens aperture combination is marked in *red* on the front of each shutter. The lens is pre-focused at the factory.

7. The magazine will accept up to 100 feet of any standard double perforated 35mm film. Eight exposures are made on one foot of film, making possible up to 800 pictures with one loading.

8. The complete picture taking cycle is accomplished by a simple operating arm. A forward movement actuates the shutter, and a reverse motion advances the film. An interlocking device prevents double exposure.

9. An exposure counter indicates at all times how much film has been consumed.



2. **THE GRAFLEX IDENTIFICATION UNIT** completely assembled. Numbers identify the principal parts . . .

1. Movable camera platform.
2. Elevating wheel for camera platform.
3. Mirror for subject to focus eyes on.
4. Frame of picture area.
5. Index numbers are photographed below subject and changed at camera position.
6. The camera body.
7. GE reflectorized lamps, Type R40 Reflectorized Flood or 300 watt and 150 watt lamps.
8. Reversible background screen.
9. Three wheeled base.
10. Upright stand.

10. A movable platform with wire frame at one end permits positive placement of individuals of varying heights.

11. A mirror is mounted near the lens. This acts as a focal point for the subject's attention and results in more pleasant expressions.

12. The entire unit is easily moved from one department to another and can be locked into position by a foot operated jack-lock to prevent accidental movement during actual operations.

13. A focusing panel is furnished so that the alignment of background scale can be checked when unit is first put into operation.

14. Standard 35mm film processing equipment and technique can be used.

15. Sturdily constructed, it is designed for strength and rigidity.

Operation of the Identification Unit

The unit can be placed anywhere within an office, a studio or factory, requiring for its operation only a space about 5 feet wide by about 8 feet long for the complete unit. Only one connecting cord is necessary. The two lamps are inserted in position. Directions which accompany each unit, explain in detail the loading of film in the magazine. When the film has been loaded and height scale checked on the ground glass of the focusing panel, the operator is ready to begin his operations. For quickest results it is recommended that the employees be lined up. An assistant can assign an employee identification number in numerical order and at the same time make out a file card with employee's name, department, etc. and with assigned identification number. In this method with numbers being assigned in numerical order, it is a simple matter for the operator to change the identification number on the unit and his rate of speed can be estimated to be easily from four to eight persons per minute.

The individual to be photographed steps into position before the background screen. The operator lowers or raises the platform so that the subject is perfectly centered within the area of the wire frame. The person is asked to look into the mirror placed near the lens. In this way he can check to be sure he is perfectly centered and this almost always results in a more natural expression. The operator then pushes the operating arm forward, making the exposure. He then pulls the arm back which advances the film one exposure and sets the shutter for the next exposure. The next step is to change the identification number by one number, and he is ready for the next person. This is all accomplished within the space of a few seconds.

Badges and Pass Cards

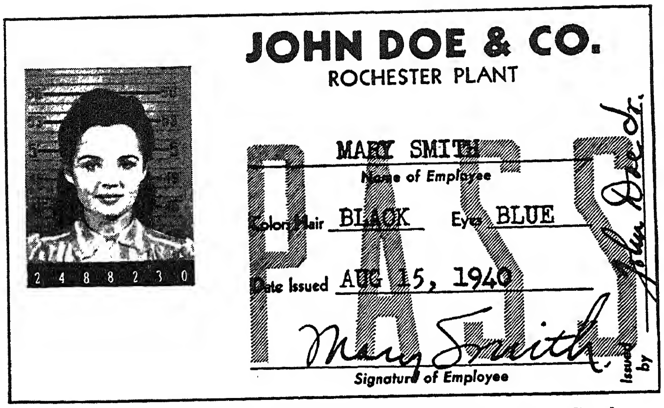
Whenever the operator is through for the day, he can remove whatever portion of the film has been exposed or the complete 100 or 50 foot roll, as the case may be. The film can be developed in any standard 35mm developing equipment such as the Stineman system or other equipment which will accommodate the lengths of film to be developed. The negatives are then ready for printing on the photographic pass-card or all-photographic badge. The pass cards are all-photographic to the point where typed matter and signatures are added to complete the card. However, the badge can be made completely all-photographic and once the badge print is dried it is ready for assembly within a badge, requiring no additional work.

3. and 4. Rimless Celluloid Badges, 1¾" Diameter. In spite of its low cost, this type of Photo Badge has been found to be one of the most difficult to take apart and, when tampered with, it cannot be successfully re-assembled—thus affording tamper-proof protection.

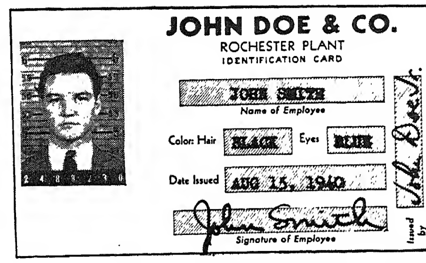
The upper badge is an "ALL-PHOTOGRAPHIC" unit. The lower — is an "ASSEMBLED" badge produced from a strip print masked with colored paper, available with or without suitable imprint.

Pass Cards

The recommended size for a pass-card is about $2\frac{1}{4}$ x $3\frac{3}{4}$ inches which will fit the average purse or bill-fold. Master copy is first drawn up including all the necessary information to appear in the finished pass-card, such as company name, employee description, department, floor, building, and spaces for signatures. In drawing this copy it will be well to make it twice the size of the finished pass-card. On later copying it, the negative can



5. Above is a full-size reproduction of a typical Pass Card, 2¼" x 3¾".



6. Pass Card of another form is reproduced half-scale.

be made to the desired size. Drawing it on a 2 to 1 scale will make it much easier for the artist or draftsman and the finished result will be cleaner and sharper. The finished negative should be of a very high contrast and a film such as Kodalith will produce it satisfactorily.

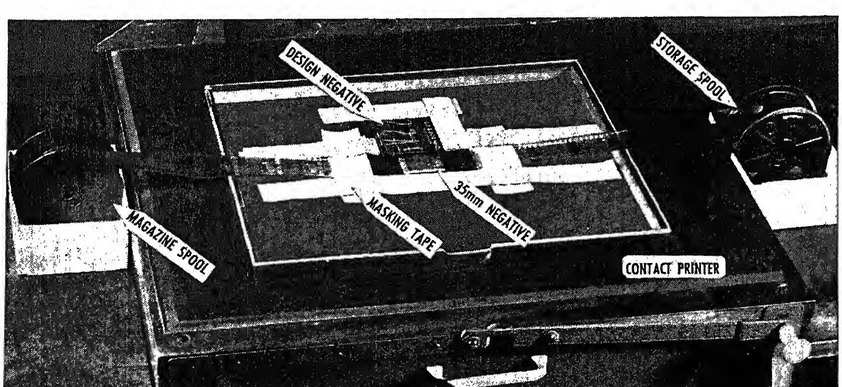
A window is then cut out on the finished master design negative through which the identification negatives are printed. The accompanying illustration will show how the changing 35mm films are printed with the master design negative making the finished pass-card a single printing operation. These pass-cards can be printed on any standard contact printer, available in any photographic laboratory. The pass-card negative is held in place by scotch tape and the roll of 35mm film is placed so that each picture can be successively advanced and printed through the window on the master design negative. A contact print is made on 2¼ x 3¾ double weight, semi-matte paper and the 35mm film is then advanced for the next printing. This operation is continued as fast as the printer can work.

When the pass-cards are completed, they are ready for the employee's signature and also the signature of the person issuing the pass. To make these cards as tamper-proof as possible, various methods are used. In some cases, special inks are used for typing the description and others have used perforating typewriters. When a perforating typewriter is used, its characters perforate the emulsion. If erasures were attempted, the ink could be removed, but the perforations would remain, making it extremely difficult to make any changes. Another method of protecting pass cards is to place them within a transparent card-holder and run a grommet—metal eyelet—through both the card and holder. This will serve as a protection for the card in several ways. It will discourage removal of the card from the holder and thereby prevent it from getting dirty and it will also discourage removing the card to make changes.

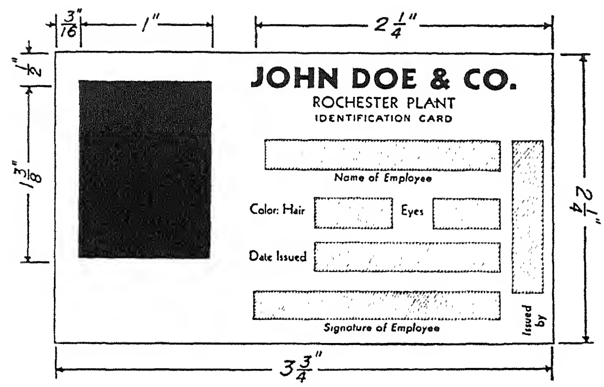
A company seal placed over the individual's picture will make spurious copying a difficult matter. Some have laminated the finished pass-card between two pieces of celluloid. Usually the pass-card is inserted into a transparent acetate card holder to protect it.

Identification Badges

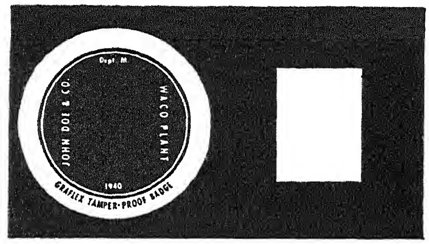
Another use for identification pictures is in the form of tamper-proof badges which today are extensively used by many government agencies and by private industry. The accompanying illustrations show prints which have been made with a master design negative and also the



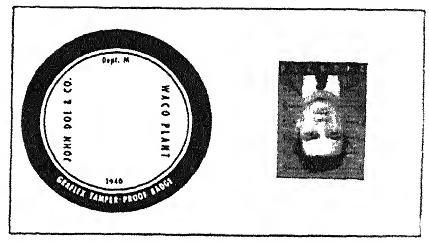
7. PASS CARD PRINTING. A few strips of scotch tape and a standard contact printer — all that is required to combine design and portrait negatives *simultaneously* into all-photographic, tamper-proof pass cards. Illustrated in use above is the No. 3 Crown Printer.



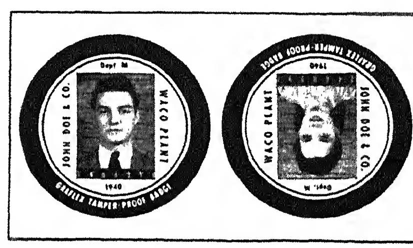
8. Layout for the Pass Card design negative.



9. Negative (approximately one-half actual size) used for printing legend and portrait for two badges in two operations on a single sheet of photographic paper 2¾" x 4½".



10. Print (approximately one-half actual size) from *first exposure* of paper through the negative in Figure 9. Note the alternate printing of legend and portrait.



11. Print is completed by rotating paper and exposing a second time. Paper is now ready for processing and cutting with the circular die furnished with each hand press.

12. Information included in photograph may vary depending upon individual requirements as shown in samples A, B and C. See text.

finished badge known as the all-photographic. (Fig. 3.)

In making the all-photographic badge, a master negative is prepared which contains the information wanted in the finished badge. The illustration of a sample negative shows what it should be like. Prints from this negative can be made so that two or more pictures can be included on a single sheet of paper by multiple printing. The resulting prints are then die-cut to proper size for inserting in the badge. These prints can also be made on any standard printing equipment. The paper used must be cut to the exact size so that when making more than one badge print per sheet of paper, correct registration will result. (See Figs. 9, 10, 11, 12.)

In making badge prints of 2 or more on a single sheet of paper the following procedure is followed. The master design negative is positioned on the printer and is attached with Scotch tape to prevent an accidental shift. The portrait negatives are placed so that each can be successively positioned through the window on the master design negative. The first exposure, on paper which is cut to exact size, will produce a print similar to Figure 10, alternately printing disc with legend and portrait. The paper is then completely rotated and the portrait negative is advanced. A second exposure will then print a portrait within the disc with legend and will also print the disc with legend around the portrait printed with the first exposure. The second exposure will produce a print similar to Figure 11. By making these badge prints in this manner, although a double printing process is involved, the net results are actually two prints. These disc prints are now ready for die-cutting and immediate assembly within the badges.

In many cases, badges of different colors to designate various buildings or departments are desired. Strip prints are then made and these prints are assembled within the badge with colored masks. The masks may be obtained in various colors either with or without the necessary printing. The contact printing paper is purchased in rolls 1⅜ inches wide. For rapid printing there is available a Stineman continuous printer (for making 35mm strip prints) which is motor driven and will print 800 pictures in approximately four minutes. This paper can also be developed on the regular Stineman developing reels obtainable in 50, 100 and 200 foot capacities. For printing shorter lengths a standard contact printer can be used, printing from six to ten exposures at one time.

Single weight paper is best for this job. Glossy paper

can be used and the prints can be dried without ferrotyping. If ferrotyping is preferred, the prints can be cut into short strips. The longer strips can be dried on a standard rack as used for drying film in long lengths and they can also be run through a standard rotary dryer.

Recently a new paper became available which is ideally suited for strip printers such as the Stineman Continuous Printer. This paper is of single weight and is double perforated. The paper is an Ad-Type stock which makes it resistant to tearing or cracking when handled roughly either dry or wet. It is coated with a fast Kodabromide emulsion and has very good tonal qualities. It is known as Eastman Recording Paper No. 1003.

In many cases it will be desirable to include additional information in the negative. This information might be the firm name, employee name or additional indexing systems. For cases where the company name is wanted, a printed sign can be made up and it can be positioned so that it will appear properly in the negative. Figure 12A will illustrate this method. This picture was made with the Graflex Identification Unit. The sign was placed at the end of the platform, directly above the numbers and it was held in place with card clips. This method is quite simple in that one sign only is needed because it will be the same in each negative. However, in those cases where employees' names and additional numbering systems are wanted, a more flexible method is required. This can be accomplished by using magnetized characters on a metal shelf. These characters are available in either numerals or letters and in various sizes. Figures 12B and 12C illustrate the use of these characters. These pictures were also made with the Graflex Identification Unit. Figure 12C shows the use of employee's name in addition to the regular numbering system. A suitable metal shelf was attached to the end of the platform with the aid of several retaining strips. The magnetized characters were arranged to give the desired effect. Figure 12B illustrates the use of the magnetized characters only, eliminating the regular numbers. In this case the metal shelf is placed over the numbering system on the unit. With the aid of the magnetized characters many other arrangements are possible.

The finished badge can be made up in any shape or size. Some are all-metal and some are metal-and-celluloid. It is believed by many that the identification badge offers the best tamper-proof features because any attempt to change it will result in destruction of the badge.

An important point to keep in mind when selecting a badge for employee use is the fact that the lighter weight badge will not be as detrimental to clothing as one of heavier construction. This, of course, is especially true in those cases where women employees will be wearing these badges. Women's clothes are usually of light-weight materials and the heavier, all-metal badges, would tend to damage them. This danger is considerably lessened by the lighter weight rimless badges.

This tremendous field which is steadily becoming greater offers unlimited advantages to the alert professional photographers. There are many smaller manufacturing concerns with only several hundred employees who would like to have their personnel photographed. The Graflex Identification Unit can be easily transported directly to these plants and the actual photographing accomplished in several hours. With a Graflex Identification Unit, a photographer can bring much of this work his way, not only in photographing the employees, but also in making the pass-cards and badges.

Many personnel directors prefer to issue to their employees both an identification pass-card and an identification badge. This is for cases where the most rigid control is in effect. The badge is intended to be worn at all times, whereas the pass-card is to be carried on their person so that the employees can at any time, upon demand, show this pass-card which is their authority to wear the badge. Further, a duplicate of this pass-card is kept in the company's files and, if at any time an employee is transferred from one plant to another, this duplicate pass-card is forwarded through the mails to the employee's new headquarters. When this identification card is received by the proper authorities at the new destination, they can easily compare it with the pass-card and badge which the employee has in his possession when he is reporting for work on his new job. This makes any fraud or deception almost impossible.

Although Personnel Identification has been used for years in some form or another, it is still in its infancy. However, through the medium of photography, it is steadily coming into its own and the possibilities for Identification photography present countless opportunities. Besides being used by our government and private industry to protect the workers and their secret operations, this type of photography is being extensively used by schools and private institutions. Many schools are making photographs of each of their students. These photographs are attached to the student's record and kept on file at all times. High schools and Universities are using photographic identification in issuing season tickets for athletic events, to prevent unauthorized persons from making use of these tickets. Police departments throughout the country are using Photographic Identification for their criminal files. Passport, hunting, drivers and fishing license photography would be simplified a great deal with the Graflex Identification Unit.

SPEEDLAMP PHOTOGRAPHY

H. E. EDGERTON · K. J. GERMESHAUSEN
H. E. GRIER

Photographing high speed action at 1/10,000 second or less may at first seem impossible with our modern cameras. As no camera shutter can operate at such a top speed we started with the light itself and over a period of years finally developed the "Speedlamp" apparatus. Experimental work was carried out by the authors at the Massachusetts Institute of Technology. With this new light the actual exposure is made at the fraction of a second when the "Speedlamp" is flashed. The camera shutter may be set at Time exposure if the room is dark, otherwise the shutter is usually adjusted to operate at 1/100 or 1/200 second to avoid picking up any strong room illumination and making a secondary image.

Historically, it is interesting to note that Talbot, who shares with Daguerre the early fundamental ground work of photography, took pictures of rapidly rotating discs with the flashes of light from an open spark. He described the process in 1851 and enthusiastically commented on the possibility of studio photography with the light from a spark.

It is a far cry from Talbot's open spark method which could illuminate only a small area, to the powerful modern Speedlamp that has resulted from recent developments in electronic tubes for producing light and for its accurate control.

The Speedlamp electrical flash lamp is capable of producing a flash of light lasting less than 1/10,000 second. Flashes under special conditions have been shorter than one millionth of a second. The exposure time of a photograph taken with the flash depends entirely upon the duration of the flash as long as any other light does not produce an image. Electrical synchronization of the camera shutter and the light is essential in order that a short shutter exposure be used and that the light produce its flash at the moment the shutter is wide open. There is no appreciable time delay between the closing of the synchronizing switch and the flash of light, thus requiring an instantaneous type of synchronizer switch on a between-the-lens shutter. The light cannot be used with a focal plane shutter except for the full opening.

The electrical flash tubes have a life of 5000 to 10,000 flashes before they begin to lose efficiency or fail to operate properly. The color of the light is blue-white and, due to the extremely short duration of the flash, the lights do not bother the eyes as much as the common variety of flashbulb, producing the same photographic effect. As many lights as desired can be flashed in parallel, substantially at the same instant. Synchronization of multiple lamps is obtained either by a trip wire (of small size, since it carries practically no current) or by the use of a photocell pick-up device on each lamp, this

1. Kodatron Speedlamp set up ready for use. This outfit consists of a gas-filled bulb in suitable reflector and mounted on a movable stand. The box on the base contains the essential parts for operating the flashlamp. There is a 50-watt pilot lamp in the large bulb for use in directing the illumination when setting up the equipment. See next page for additional explanation.

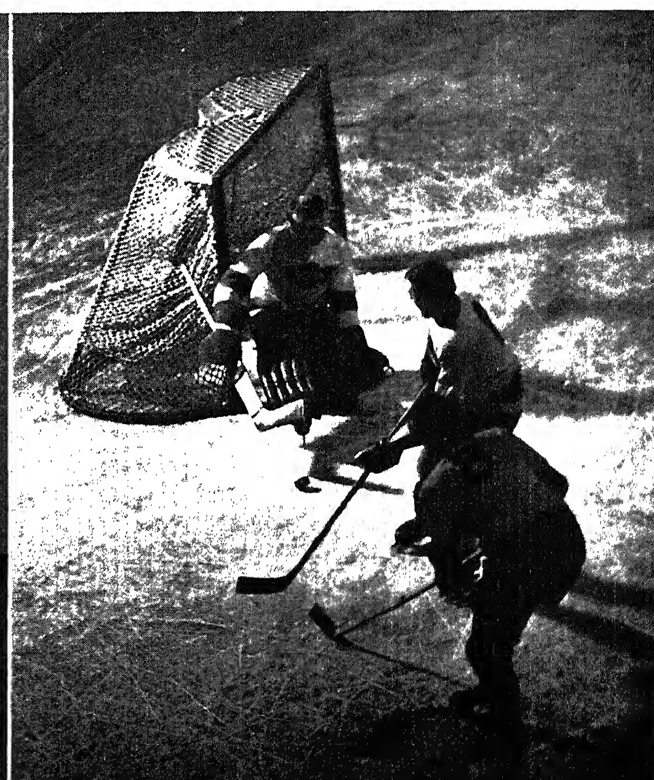
flashes the light when the photocell receives light from the other flash tube or tubes.

The power requirement is about 400-watts for each unit for a matter of a few seconds to fill the electrical condenser with energy in preparation for the next flash. This charging rate of the condenser limits the flashes to a maximum rate of once each ten seconds. Special electric flash lamps with appropriate circuits have been operated at much higher rates. Examples of these are featured in "Flash," a book of high-speed photographs published by Hale Cushman and Flint of Boston.

The first cost of Speedlamp photography is apparently high—a single unit complete involves an outlay of approximately \$400—however, the cost per flash is much below the cost of flashbulbs. Retiring the cost of the unit after 100,000 flashes and assuming the average life of the flash tube to be 7500 flashes, the cost per flash, including an allowance for maintenance, is less than a cent. In any application where a large number of pictures are taken "Speedlamp" photography is therefore economical. The mobility of electrical flash photography is limited somewhat by the weight of the apparatus (about 60 pounds) and the necessity for electrical power. Available apparatus operates from 110-volt, 60-cycle, alternating-current power.

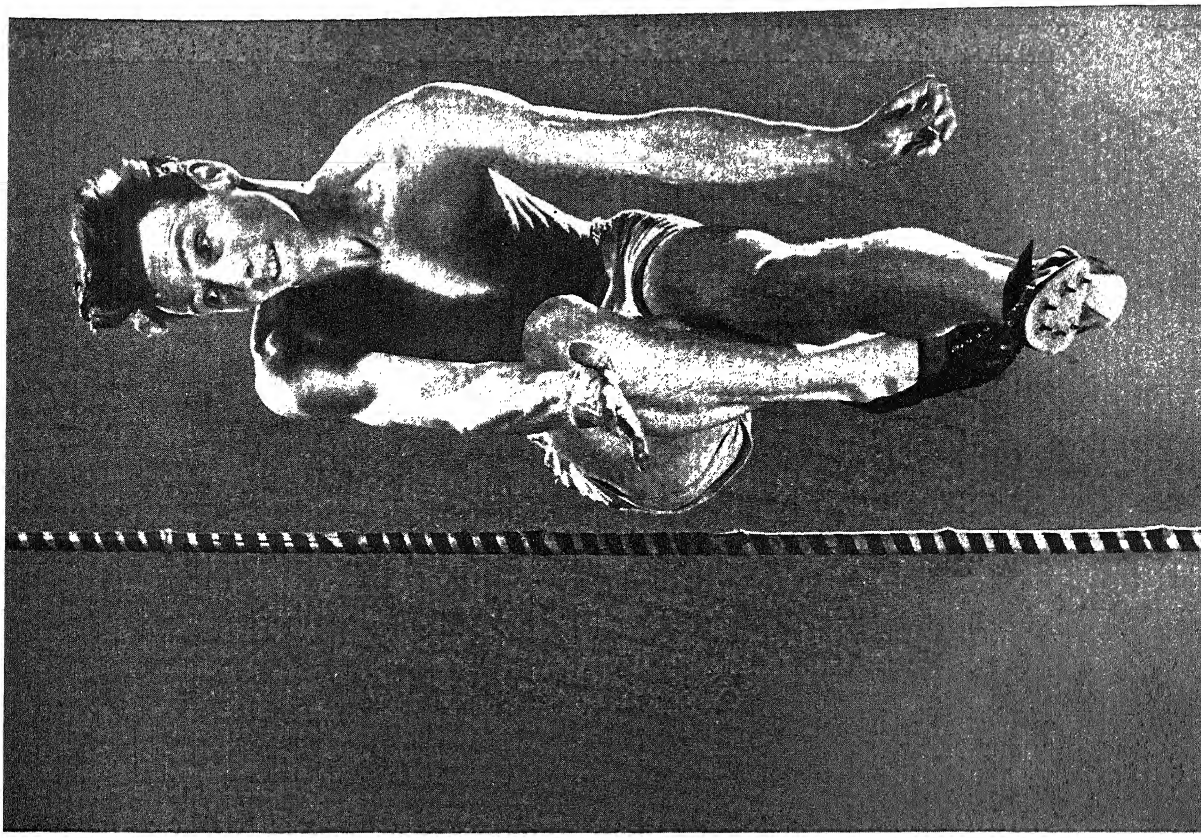
A Kodatron Speedlamp unit is shown in a photograph accompanying this article. The box on the base contains the essential parts for operating the flash tube. A cable connects this box to the lamp and the reflector above. The controls for the lamp are exceedingly simple to operate. First, after the power cord has been connected, the unit is turned on by the switch marked "power." A pilot lamp immediately lights up showing that the power is on. After ten seconds the condenser is full and a push on the "trip" button switch will cause the lamp to flash. Ten seconds are required after each flash to charge the condenser for the next operation. A small two-prong polarized plug is provided from which a connection is made to synchronize a camera shutter or other contactor. This trip connection goes to the grid of the control tube, and in this way no appreciable current is required for starting the flash. This permits a simple

2. The Speedlamp unit offers interesting possibilities for all types of studio photography, especially for children. There is no continuous bright light required. The action can be snapped at any time without fear of blur on the negative.



3. Speedlamp photo of hockey game. The 4 x 5 Speed Graphic camera with synchronizer was located in the photographers' cage at the Boston Garden. The 12-inch lens was set at f/9, using Fast Pan film. One Speedlamp hung 60 feet above the ice and directed to illuminate in front of the goal. A second Speedlamp placed directly behind the goal at a height of 10 feet. A third Speedlamp at the side near the camera.

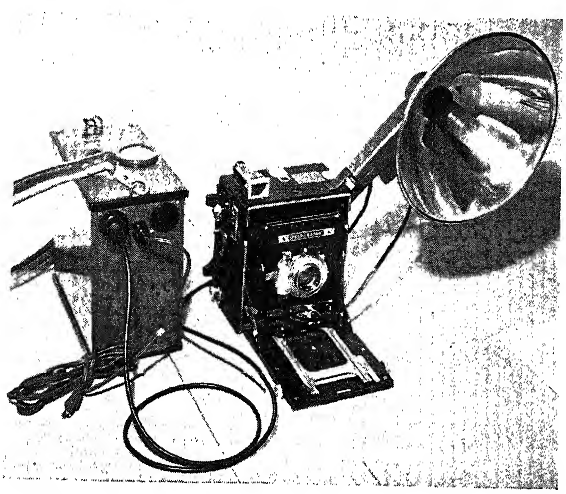
4. HAZEL FRANKLIN . . . FIGURE SKATER. High speed photograph for LIFE Magazine by Gjon Mili.



5. PERFECT FORM. High speed flash picture taken for LIFE Magazine by Gjon Mili. Light directed from three different sources to give effect of daylight. Note how lower arm is tense and upper arm is fairly relaxed at this moment. Taken at 1/30,000 second.

synchronizer operating on the moving parts of the shutter to operate the flash. Other electrical flash units are tripped in parallel by connecting their trip terminals together with extension cords or by photocell trips.

The condenser for this unit is rated at 112 microfarads and is charged to 2000 volts. The effective peak of illumination of each flash of light lasts about 1/10,000 second. The light from one flash is ample to photograph a full-length portrait of a person at f/22 with the light located at the camera and using Kodatron Panchromatic Film. The photographs of difficult subjects accompanying this article show results actually obtained with one to three lights. Specific details of the arrangements are given for each example.



Kodatron Portable Speedlamp

The high speed characteristics of the Kodatron speedlamp are now available in a special portable unit. This new portable outfit has the same operating principles and features as the standard unit. Additional features include light-weight, easy portability and the fact that it is independent of any electrical supply. With these features it is especially adaptable for news, sports, society, industrial and scientific photography.

The power unit weighs 16 pounds and is easily carried by means of a shoulder strap. In actual operation

PORTABLE KODATRON SPEEDLAMP, powered by a rechargeable battery, will deliver over 200 uniform and powerful flashes from each battery charge. Its 16 pound power unit is easily carried by shoulder strap. The 9 inch adjustable reflector mounts on the camera. This efficient unit, costing half as much as the standard Kodatron Speedlamp, will also operate from regular 110-volt A.C.

6. **FROZEN MOTION.** Bill Jones of the International News Photos caught this high speed flash of William Fritz, Charles Beetham (winner), and Charles Quigley as they rounded the bend at the indoor track meet at the Boston Garden. Three high-speed lamps were used. Lens diaphragm set at f/16 on the 4 x 5 Speed Graphic camera, using Fast Pan film.

BATON TWIRLER . . . Speedlamp, 1/30,000 second, f/22, Super Panchro Press film. Photographed for LIFE by Gjon Mili.

this unit can be removed from the shoulder if necessary when actually on the scene. The reflector and flash tube assembly is mounted directly on the camera similar to the ordinary flash synchronizers.

The power unit is capable of storing up enough energy for 200 flashes before recharging. Each flash is of uniform intensity. The power unit can be operated from a standard 110-volt A.C. electric current. Recharging a completely exhausted unit takes from 8 to 10 hours.

There is an outlet in the power unit for a second lamp for extension flashes. When two lamps are used the total light is approximately the same as when one lamp is used, each lamp receiving one-half of the total.

The exposure guide number with a portable Kodatron speedlamp is 220. By dividing the lamp to subject distance into this figure you determine the diaphragm stop. For example, f/22 at 10 feet, or f/6.3 at 35 feet is the correct adjustment when using Kodatron panchromatic film.

The exposure guide number for the standard Kodatron speedlamp is 320 when using Kodatron panchromatic film. For professional Kodachrome, daylight type, a guide number of 25 is recommended. The new Kodatron tube gives an exposure guide number of 380 to 400 for black and white and 40 for Kodachrome.

A great deal of favorable comment has been received regarding the absence of glare, following the flash, on the audience and the actors, at indoor evening events. Apparently the extremely short blue-white flash does not leave as much of an impression on the eyes as the light from a flashbulb. Undoubtedly the shortness of the flash may have some bearing, but also the color of the light has something to do with it.

With electric-flash photography all the light from the flash is used in obtaining the image. This is not the usual case with synchronized flash photography since the shutter operates more quickly than the photoflash bulb. Under some conditions 90 per cent of the light from a flashbulb is not used since the shutter is closed.

Several interesting possibilities arise with electric flash photography such as the use of several cameras. For example, pictures of the Folies Bergere were made with three cameras. One photographer with two cameras was in one of the boxes. A 12-inch lens made it possible to get a close-up of an individual performer while the shorter focus lens covered the entire stage. Both cameras were connected and ready to click as important action came into play. The third camera was located on the other side of the theater near the stage for obtaining low angle shots of the dancing. The camera operators were required to wait ten seconds after each flash before either one could snap a picture.

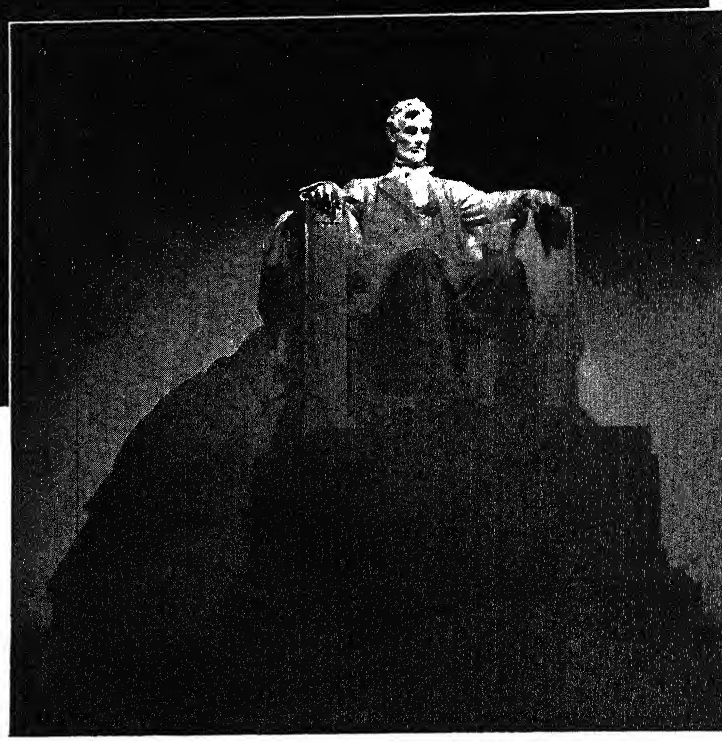
The arrangement of lighting equipment at sports events or in a theater is greatly hampered by factors other than placement for the best lighting. The first requirement is that the view of the paying customers must not be blocked by the lights. Furthermore the lights should not be directed at the audience any more than necessary. One fairly suitable position for some of the lights is above the action, especially indoors, such as on a stage or in a large auditorium where there are provisions for hanging lights from above. The picture of the Sonja Henie Ice Revue was taken with one light of the type described in this article. The light was hung 50 feet from the ice at the Boston Garden in an 18-inch aluminum Alzak reflector. Reflection from the ice was important in building up the exposure from below.

INDEX

To bring you up-to-date on

KODAK FILMS

in rolls, packs and sheets for Graphic Graflex Photography



Made on Kodak Panatomic-X For pictorial work Panatomic-X offers distinct advantages. Its microscopic grain permits the enlargement necessary for exhibition prints, while preserving fine detail and texture. A Type B panchromatic emulsion, it is equally suited to photography with artificial light, or in daylight with correction filters.

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Kodak Panatomic-X. Because of its microscopic grain, this is the film for big, brilliant enlargements. Panatomic-X is fully panchromatic, with speed ample for ordinary purposes. Rolls, packs, sheets.

Kodak Plus-X. A reliable all-round film, with high speed, fine grain, full panchromatism, sensitivity well balanced for both daylight and artificial illumination. Responds accurately to color filters and yields excellent photographic quality. Rolls and packs.

Kodak Infrared. With a Wratten Filter A (No. 25) increases the photographic visibility of distant objects. Gives dramatic sky effects, and may often be put to startling and effective use with architectural subjects. Rolls and sheets.

Kodachrome Professional Film. For gorgeous full-color transparencies. Requires no extra equipment for taking; the color is in the film. Supplied in two types: Daylight Type, balanced for average sunlight conditions, and Type B, balanced for tungsten light with color temperature of 3200° K. Prices include processing. Supplied in sheets only.

Eastman Portrait Panchromatic. Long recognized as the standard "pan" film for all types of portrait work. Its accurate monochromatic rendering also makes it a favorite for landscape and marine photography. Supplied in sheets only.

Eastman Super Panchro-Press. A fast film of the press type, specially treated to resist abrasion. An excellent choice for high-speed photography in dull daylight or under existing light conditions at night. Yields brilliant negatives suitable for illustrative work. Panchromatic. Sheets only.

Eastman Super Panchro-Press, Type B. Similar in all respects to Eastman Super Panchro-Press, with the exception that the red sensitivity is lower. This makes Type B more suitable for Photoflash exposures, and results in superior rendition of flesh tones in portraiture. Sheets only.

Eastman Super Ortho-Press. A high-speed orthochromatic "press" emulsion suited to many special purposes. Ideal for synchronized Photoflash photography. Preferred by those who develop under a safelight. Supplied in sheets and packs.

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Eastman Tri-X Panchromatic. Fastest of all Eastman sheet films. Specially balanced for commercial studio lighting, Tri-X is unexcelled for work with models and other subjects requiring short exposures. Sheets only.

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Made on Kodak Super-XX Film A good illustration of this film's ability to cope with fast action. Made at 1/400, f/6.3, with synchronized flash. Note the resulting wealth and brilliance of detail.

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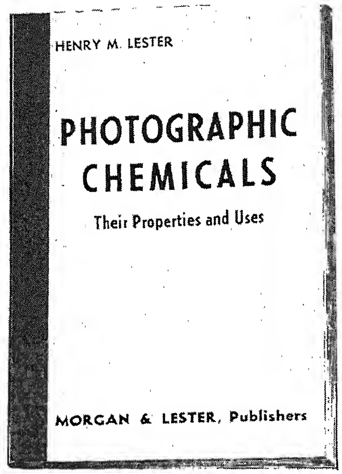

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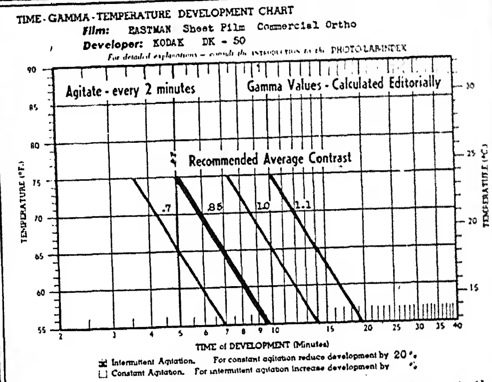

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A famous photographic technician recently said: *"Most photographers will never know* what good pictures they really get . . . UNTIL they discover the *'unconscious mistakes'* that mar 7 out of 10 negatives! Day after day, they capture on their films—*results that never come through in the finished pictures. And they don't suspect it!* Simply because their *'unconscious errors'* (inaccurate *matching* of time to temperature—of developer to emulsion—inexact preparation and handling of formulas—confusion about photo-chemicals)—*steal* the sparkle—*hide* the true values—their finished pictures *could* have. To say nothing of misconceptions about film characteristics, filters, exposure and lighting, etc.—that mark the tiny difference between a thrilling picture and a dud."

A Whole Library in 452 Pages

Fortunately, these errors that *creep in, unknown*—*can* be corrected easily. Ten thousand serious photographers found the key to *what to do in the darkroom* through Photo-Lab-Index. Here, packed into 452 convenient pages of the new TWO-volume edition, is an exhaustive library of *authentic* photographic data. So standardized, so logically arranged, so completely cross-indexed . . . that what you need to know fairly jumps out at you.

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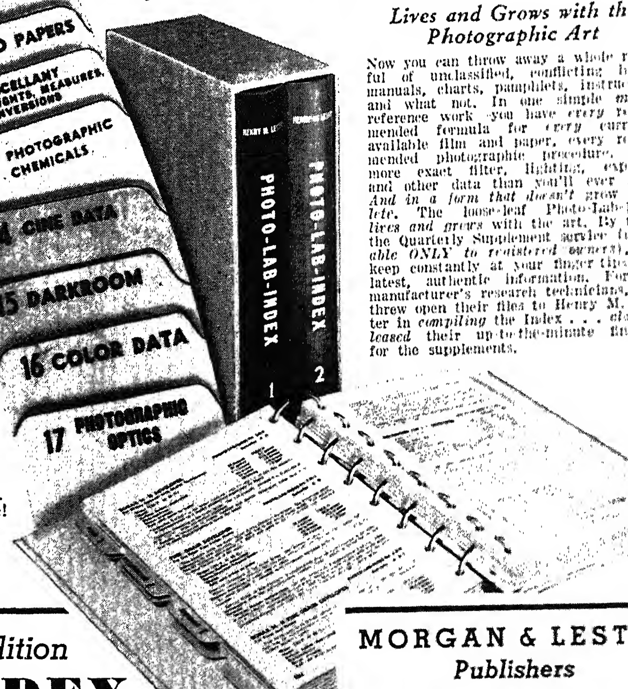
Now you can throw away a whole roomful of unclassified, conflicting books, manuals, charts, pamphlets, instructions and what not. In one simple *master* reference work you have *every* recommended formula for *every* currently available film and paper, every recommended photographic procedure. *Plus* more exact filter, lighting, exposure and other data than you'll ever need. *And in a form that doesn't grow obsolete.* The loose-leaf Photo-Lab-Index *lives and grows* with the art. By using the Quarterly Supplement service (*available ONLY to registered owners*), you keep constantly at your finger tips, the latest, authentic information. For the manufacturer's research technicians, who threw open their files to Henry M. Lester in *compiling* the Index . . . *also released* their up-to-the-minute findings for the supplements.



NEW, revised, TWO-VOLUME Edition

PHOTO-LAB-INDEX

by Henry M. Lester

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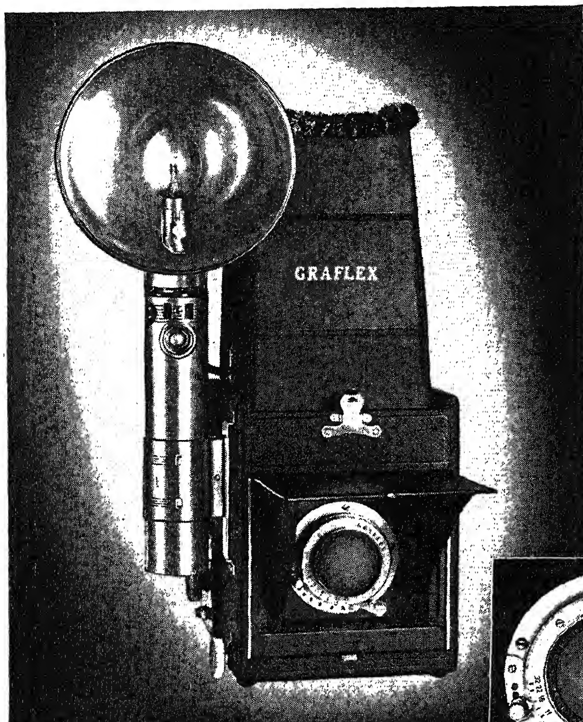
AMERICAN-MADE Prize-Winning CAMERAS

A PARADE OF NEW PRODUCTS

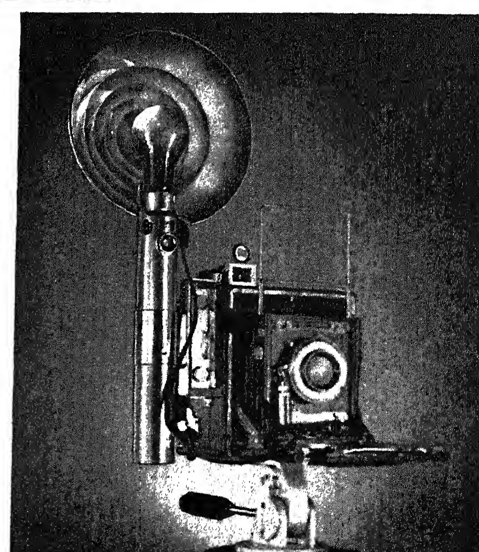


$3\frac{1}{4} \times 4\frac{1}{4}$ Super D GRAFLEX with Automatic Diaphragm and Built-in Open Flash Synchronization

Here is the biggest camera development in years! This Super D Graflex gives you faster, easier, more accurate picture-making indoors or out! With it you focus with a *wide-open lens* and a brilliant image on the ground glass. Press the shutter release and *instantly* the diaphragm closes to any pre-selected stop. Combine this automatic diaphragm with the built-in open-flash synchronization and you capture depth and detail that give thrilling realism to your pictures. Even rapid action is easy to stop when the latest *SM* lamps (approximately 1/200 second exposure) are used. Re-styled controls and finish give new, modern appearance. 100% American-made! The conventional 4 x 5 R. B. Series D Graflex is available for those who need or want somewhat larger negatives. See them at your Dealer's.

GRAFLEX FLASH SYNCHRONIZER

This, the first truly dependable synchronizer, ***stays in sync*** in spite of wide fluctuations in battery strength. It operates on all flashlight cells that fit it, has a built-in focusing spotlight, outlets for multiple flash, focal-plane synchronization and remote control, reflectors with built-in lamp ejectors and which accept bayonet-base and medium-base lamps, and extremely compact solenoid release. Available in 2-cell and 3-cell sizes.



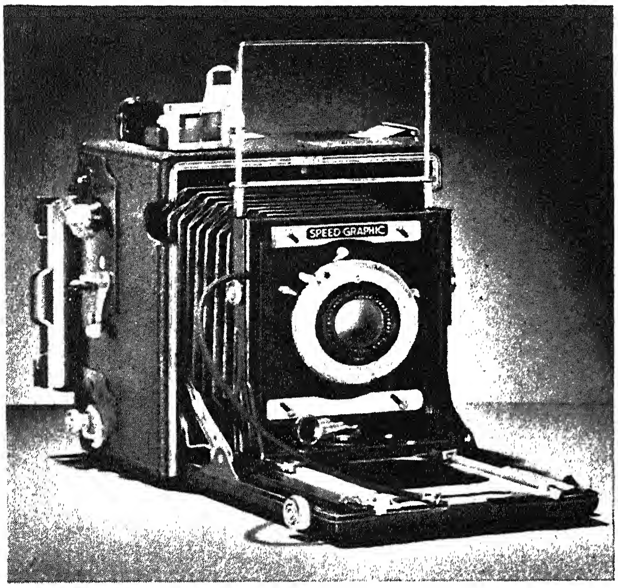
GRAPHIC PAN-TILT TRIPOD HEAD

An ideal accessory for both still and movie work. Its $2\frac{1}{8}''$ square top and circular base $3\frac{1}{2}''$ in diameter afford solid support for any camera. Tilts 100° down, 25° up and rotates a full 360°, all movements being controlled by a single handle. Camera clamp-screw fits all standard tripod sockets and is kept in *up* position to facilitate insertion into the camera.

GRAFLEX

ALL-PURPOSE SPEED GRAPHICS

LET'S GO U.S.A. KEEP 'EM FLYING!



Anniversary SPEED GRAPHICS

$3\frac{1}{4} \times 4\frac{1}{4}$ and 4×5

Combining great versatility, convenience and beauty of appearance with long-recognized Speed Graphic dependability, these Anniversary models have all the characteristics necessary to give you superior pictures under all conditions day or night! Their many distinctive features, in addition to all those which have for many years made Speed Graphic the chosen camera of professionals, news photographers and amateurs, give these cameras a greatly extended range of usefulness—make them potential prize-winners for any owner!

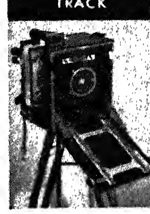
Some of the important details are illustrated below. The illustration at the left shows the all-metal drop bed, locking rigidly in position well out of the range of wide-angle lenses, as well as the tandem track which permits rack-and-pinion focusing of wide-angle lenses.

In the center are the dual focusing knobs for either left-hand or right-hand operation, a positive track-lock to lock the lens in position after obtaining proper focus, and the one-piece metal front standard with its locking lever.

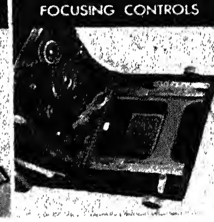
Illustrated at the right is the metal front-standard assembly that rises and shifts to the right or left to permit control of linear perspective in either vertical or horizontal picture-taking position.

A 5 x 7 Speed Graphic is also available for commercial, industrial and color photography where larger negative sizes are desirable.

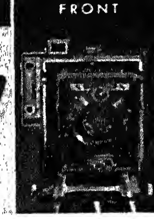
LINK CONNECTED TRACK



TRACK LOCK AND DUAL FOCUSING CONTROLS



SLIDING FRONT



$2\frac{1}{4} \times 3\frac{1}{4}$ Miniature

SPEED GRAPHIC

Never in the history of Graflex has a camera been more enthusiastically received! Although 36% smaller than any other Speed Graphic ever built, it embraces all the recognized Speed Graphic features *plus* built-in focal-plane shutter flash synchronization. It's a "natural" for 1-to-1 copying or scenics, table top or fast action, pastoral or pictorial work —in fact for all-around finer shooting night or day. Small in size but big in performance!

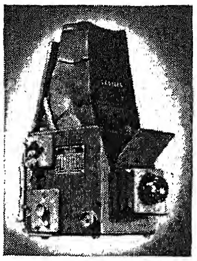
Built-in Focal-Plane Shutter Flash Synchronization

This feature provides a materially extended range of shutter speeds at which flash exposures can be made. In this camera, all focal-plane shutter speeds from 1/60 up may be synchronized with long-duration flash lamps. The new Graflex battery case, reflector and connecting cord unit is perfect for use with the Miniature Speed Graphic's built-in focal-plane flash synchronization.

GRAFLEX

AMERICAN-MADE *Prize-Winning* CAMERAS

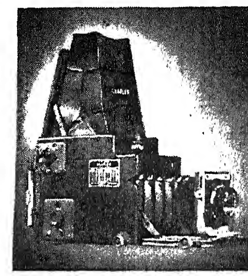
CAMERAS FOR EVERY PURPOSE



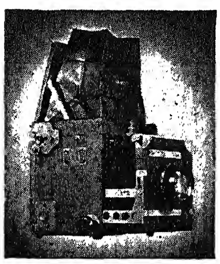
$2\frac{1}{4} \times 3\frac{1}{4}$ R. B. Series B GRAFLEX

A great all-around utility camera that is highly versatile, dependable and makes truly outstanding pictures—the basic reflex camera for fast, accurate composition. It features a 25-speed focal-plane shutter, full-vision ground-glass focusing, ability to use telephoto lenses interchangeably with its factory-fitted Kodak Anastigmat f/4.5 lens, and revolving back that enables horizontal or vertical pictures to be taken with equal facility. Uses economical $2\frac{1}{4} \times 3\frac{1}{4}$ film.

R. B. AUTO GRAFLEX



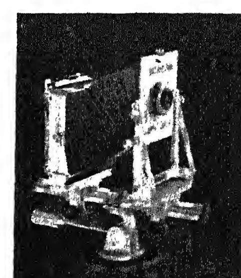
Here is a reflex camera with the wide scope needed by advanced workers. Actual size photographs of small objects, and big images of wild life or sports events viewed from afar, are within the scope of this versatile camera. Because it is ideally adapted to meet exacting requirements, it is a popular choice of advanced amateurs, professionals and scientists. Features removable lensboard, long bellows draw and focal-plane shutter. Available in $3\frac{1}{4} \times 4\frac{1}{4}$ size.



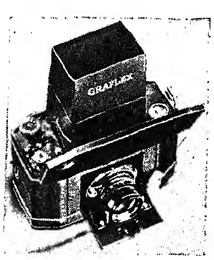
R. B. HOME PORTRAIT GRAFLEX

Here is a truly outstanding camera for interior and portrait photography. Its features include a front that raises, lowers and swings. It readily accepts a wide variety of lenses including telephotos, and has a focal-plane shutter especially adapted for indoor use. Its large picture size—5 x 7—permits the user to obtain large images without approaching the subject too closely. A camera ideally adapted for capturing those perfect instants of expression.

4 x 5 GRAPHIC VIEW CAMERA

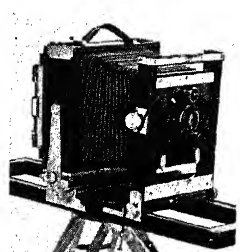


The almost unlimited combinations of adjustments available with this camera give unusual control over linear perspective and form and enable you to position the sharp field to permit working with a large stop. Clean design, simple controls, positive locks, great rigidity; swings, tilts and shifts of both lens and film; 3″ rise of the front, inverted V-section bed, bellows extensions from 3″ to $12\frac{1}{2}$″; interchangeability of lenses, combined camera base and revolving-tilting tripod head, built-in spirit level, accessory accordion-type lens shade, choice of four backs—these are some of the Graphic View Camera's outstanding features. It is the ultimate in camera flexibility and craftsmanship.



National GRAFLEX

Because this extremely compact camera—it's just a handful—embodies so many recognized Graflex features, it has been called the finest of American-made miniature reflexes. Gives ten album-size pictures from an 8-exposure film. Equipped with Bausch & Lomb Tessar f/3.5 lens.

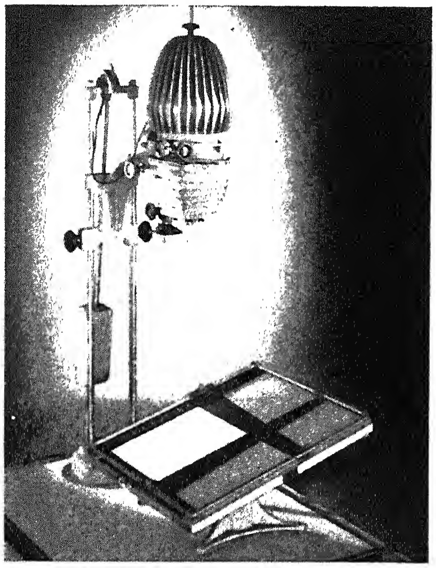


4 x 5 CROWN VIEW CAMERA

A compact Graflex-made view camera that uses economical $3\frac{1}{4} \times 4\frac{1}{4}$ or 4 x 5 film. Many adjustments give it great versatility and flexibility. 19″ bellows draw. Rising, falling and shifting front. Tilting and swinging back.

GRAFLEX

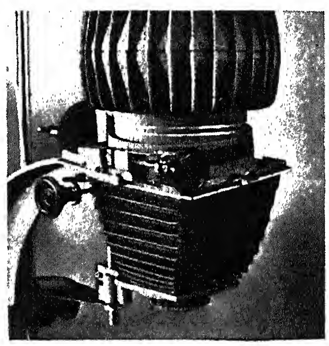
GRAFLEX *Variograph* ENLARGER



The Variograph *controls and Variograph Easel Holder tilt the negative and the paper in two planes to permit alteration of perspective with a large stop and short exposures.*

GRAFLEX *Variograph* ENLARGER

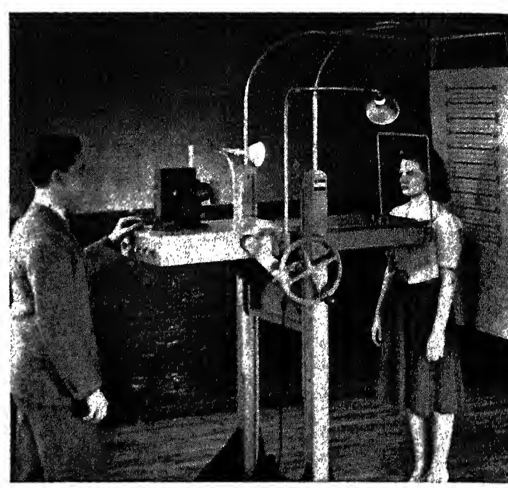
For users of cameras making negatives up to 2¼ x 3¼, this fine precision-built enlarger gives to projection printing the same freedom that a highly versatile view camera offers in the making of negatives. Of its score of new and advanced features, the *Variograph* controls are of especial interest to the serious worker. Tilting the negative carrier in two planes, this enlarger facilitates and simplifies the practice of *Variography*—the art of altering linear perspective to attain more pleasing pictorial effects. Extremely cool operation, exceptional rigidity through its tripod-type column, book-type negative carries and unusual flexibility are added features. And it accepts the lens-and-lensboard of the Miniature Speed Graphic.



Enabling you to do more things better than with any other enlarger, this versatile unit will enable you to delve into many new and fascinating fields. Built with typical Graflex precision, the Graflex *Variograph* Enlarger provides you with an attractive, lifetime darkroom unit.

GRAFLEX IDENTIFICATION UNIT

Today, when uninterrupted production is essential, wise employers safeguard the efficient operation of their organizations by identifying their employees with pictures made with the Graflex Identification Unit. Such pictures, costing less than 2¢ each for film and paper, may be used in making identification badges. Or, through a standard single-printing process, all-photographic passes may be produced easily and economically. Such passes cannot be altered without visible evidence of such alteration. For complete information concerning the many ways the Graflex Identification Unit can serve your needs, write our Industrial Division.



GRAFLEX